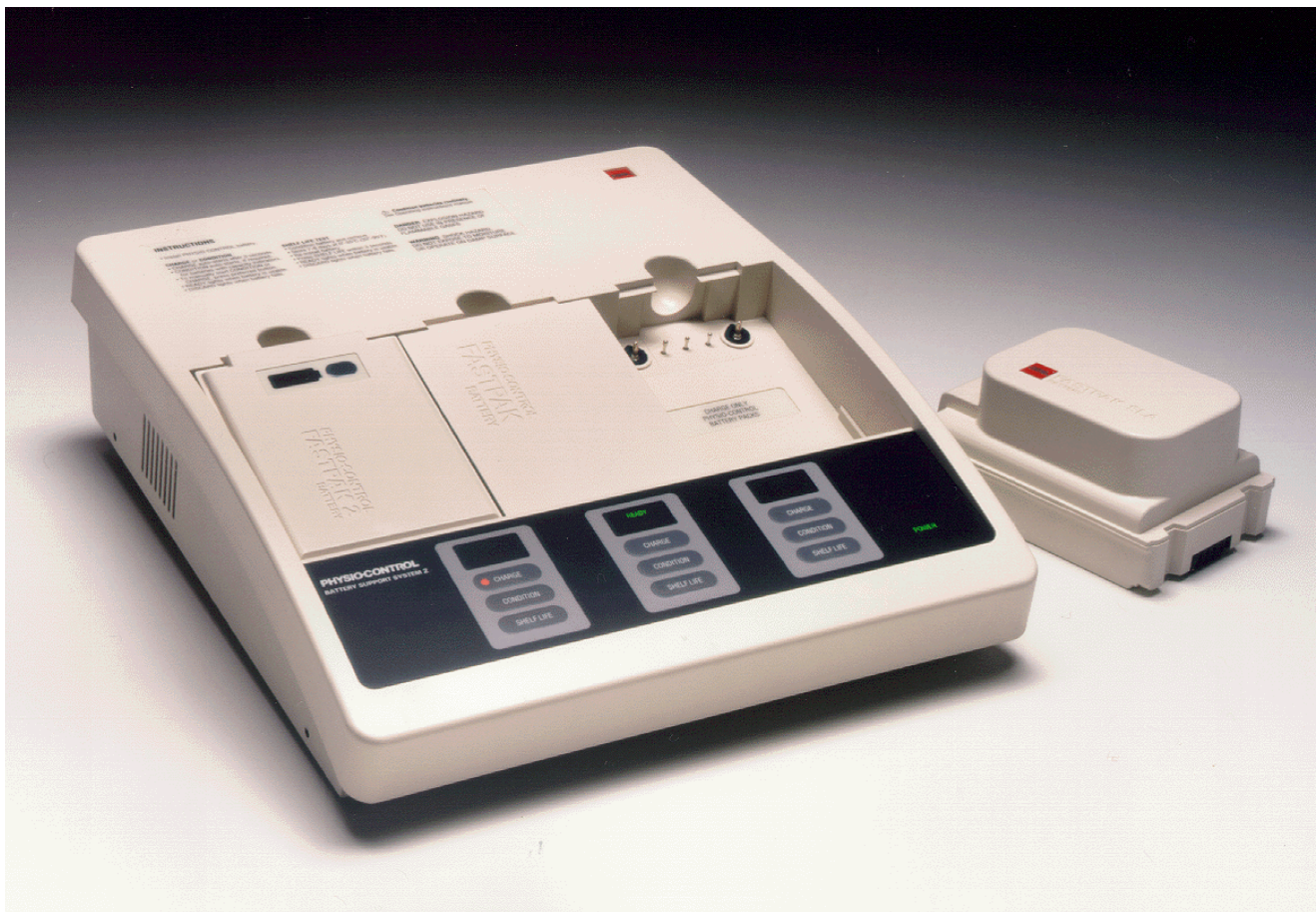




Battery Support System 2

Service Manual



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Modes of Operation	Performance Inspection	Instrument Calibration	Trouble-shooting
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Preface

This Service Manual is intended for use by qualified service personnel. It describes how to maintain, test, troubleshoot, and repair the Battery Support System 2 (BSS 2). This section covers trademarks, warranty information, safety information, and includes a glossary of frequently used terms. A separate publication, the Battery Support System 2 Operating Instructions, is intended for use by physicians, clinicians, and emergency care providers. It provides step-by-step instructions for all operating features of the BSS 2 as well as operator-level testing and maintenance.

Trademarks

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Contacting Medtronic Physio-Control Corp.

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PN 3010516-003

Service Personnel Qualifications

Service personnel must be properly qualified and thoroughly familiar with the operation of the BSS 2. Service Personnel must meet at least one of the following requirements (or the equivalent):

- Associate of Applied Science, with an emphasis in biomedical electronics
- Certificate of Technical Training, with an emphasis in biomedical electronics
- Biomedical electronics experience

Contacting Medtronic Physio-Control Corporation

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Responsibility for Information

This Service Manual describes procedures for maintenance, testing, troubleshooting, and repairing the BSS 2. It is intended for use by qualified service personnel only. The Battery Support System 2 Service Manual does not cover operation of the BSS 2 in the clinical setting. Service personnel must also consult the **Battery Support System 2 Operating Instructions** to obtain a complete understanding of the use and maintenance of the BSS 2.

It is the responsibility of our customers to ensure that the appropriate person(s) within their organization have access to the information in this Service Manual, including any warnings and cautions used throughout the Battery Support System 2 Service Manual.

Device Tracking

USA only, including US government-owned units:

The Food and Drug Administration requires defibrillator manufacturers to track the location of their defibrillators. If your defibrillator has been sold, donated, lost, stolen, exported, or destroyed, or if it was not obtained directly from Medtronic Physio-Control, please notify Medtronic Physio-Control at 1.800.442.1142, extension 4530.

General information related to device tracking:

It is important to maintain accurate records of device location within your facility or system. Maintenance of such records eases the process of locating devices should it be necessary to modify them. Medical devices should be tracked by both the manufacturer's part and serial number. Internal asset or tracking numbers may also be useful in maintaining adequate control of medical devices.

Service Information

Before attempting to clean or repair any assembly in BSS 2, service personnel should be familiar with the information in the **Preventive Maintenance** section.

Inspect any device that has been dropped, damaged, or abused to verify that the BSS 2 is operating within performance standards listed in the **Performance Inspection Procedure (PIP)**, and that the leakage current values are acceptable.

Component replacement for the BSS 2 is limited to those items accessible at the upper case assembly level. Component replacement and internal adjustments must be made by **service personnel** qualified by appropriate training and experience.

For servicing and maintaining the BSS 2, contact your local Medtronic Physio-Control service representative. In the USA, call Medtronic Physio-Control Technical Services at 1.800.442.1142. Outside the USA, contact your local Medtronic Physio-Control representative.

BSS 2 Recycling

Recycle the BSS 2 at the end of its useful life.

- Recycling Assistance – The BSS 2 should be recycled according to national and local regulations. Contact your local Medtronic Physio-Control representative for assistance.
- Preparation – The BSS 2 should be clean and contaminant-free prior to being recycled.
- Recycling of Batteries – Follow instructions provided in this Service Manual and local guidelines for recycling rechargeable nickel-cadmium or sealed lead-acid batteries.
- Packaging – Packaging should be recycled according to national and local regulations.

Warranty

The BSS 2 is warranted against all defects in materials and workmanship for a period of one year from the date of delivery.

All batteries supplied by Medtronic Physio-Control for LIFEPAK defibrillator/monitor products are warranted for a period of one year. If Medtronic Physio-Control receives notice of a battery defect during the warranty period, Medtronic Physio-Control will replace the battery upon verification of the defect.

Use of other manufacturers' batteries and accessories with Medtronic Physio-Control defibrillator/monitor products may void Safety Agency Certifications and warranty.

Safety

The Safety section describes safety conventions, terms, and symbols used in this Service Manual or on the Battery Support System 2 (BSS 2). The information is intended to alert service personnel to recommended precautions in the care, use, and handling of this device.

Terms

General Warnings and Cautions

Symbols

Acronyms and Abbreviations

Terms

Certain terms are used in this Service Manual or on the equipment. Familiarize yourself with their definitions and significance.

Danger: Immediate hazards that will result in serious personal injury or death.

Warning: Hazards or unsafe practices that could result in serious personal injury or death.

Caution: Hazards or unsafe practices that could result in minor personal injury or product/property damage.

Note: Points of particular interest for more efficient or convenient BSS 2 operation; additional information or explanation concerning the subject under discussion.

General Warnings and Cautions

Page 1 of 3

This section contains general warnings and cautions. Keep these warnings and cautions in mind when working with the BSS 2. Other, more specific warnings and cautions appear throughout this Service Manual.

WARNINGS!

Possible fire or explosion. Do not use this device in the presence of oxygen sources, flammable gases or anesthetics. Place the BSS 2 in the proper location as specified in BSS 2 operating instructions.

Possible fire or explosion. The BSS 2 is designed to be used with Physio-Control batteries only. Other manufacturers' batteries may overheat in this battery support system. Do not use with remanufactured batteries or alternate source batteries.

Shock or fire hazard. Do not immerse any portion of this device in water or other fluids. Avoid spilling any fluids on the device or accessories. Do not clean with alcohol, ketones, or other flammable agents. Do not autoclave or sterilize this device.

General Warnings and Cautions

Page 2 of 3

WARNING!

Possible loss of power during patient care. Physio-Control has no information regarding the performance or effectiveness of its LIFEPAK® defibrillator/monitors if they are used with other manufacturers' batteries or battery chargers. Using other manufacturers' batteries or battery chargers may result in device failure and may void warranty. Use only Physio-Control batteries and the appropriate PHYSIO-CONTROL Battery Support System.

CAUTIONS!

Possible equipment damage. This device may be damaged by mechanical or physical abuse such as immersion in water or dropping. If the device has been abused, remove it from use.

Possible or potential inaccurate battery charge level indicator. Using the PHYSIO-CONTROL® Battery Support System (P/N 801807) or the two-well Battery Charger (P/Ns 9-00284, 9-00288, and 801530) to charge and maintain a FASTPAK® 2 battery will eventually result in an inaccurate battery charge level indicator. Use only the BSS 2 (P/N 3010035) to charge and maintain FASTPAK 2 batteries.

General Warnings and Cautions

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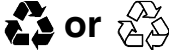



CAUTION!

Possible equipment damage. The supplied power cord is used to connect the battery support system to ac line voltage. Excessive voltage may cause fuses in the BSS 2 to blow. Before connecting the battery support system, ensure that you are using a grounded outlet of the correct voltage.









Note: The BSS 2 has no ON/OFF switch. When connecting the BSS 2 to ac line voltage, make sure that the power cord is easily accessible and is not obstructed in any way. In case of device malfunction or overheating, disconnect the device from the ac line voltage by removing the power cord.

Symbols

The following list includes symbols that may be used in this Service Manual or on the Battery Support System 2. Some of these symbols may not be relevant in every country.

	Attention, consult accompanying documents
	Recycle NiCd battery
	Recycle this product
	Direct current
	Alternating current
	Rechargeable sealed lead acid battery: Recycle battery

Symbols

	Positive terminal
	Negative terminal
	Indoor use only
	Fuse
	Manufacturing date (batteries)
	Manufacturing date (BSS 2)
	Canadian Standards Association certification for United States (Nationally Recognized Test Laboratory) and Canada
	Marking of conformity according to the medical device directive 93/42/EEC

Acronyms and Abbreviations

The following acronyms and abbreviations appear in this Service Manual.

IC	Integrated circuit
T	Slow Blow fuse
LED	Light emitting diode
NiCd	Nickel-Cadmium chemistry battery
PN	Part number
SN	Serial number
SLA	Sealed lead acid battery
BSS 2	Battery Support System 2
PCB	Printed circuit board
DMM	Digital multimeter
ESD	Electrostatic discharge
UUT	Unit Under Test
I ² C	Serial Communications Bus

Acronyms and Abbreviations

Page 2 of 2

AAMI	Association for the Advancement of Medical Instrumentation
ANSI	American National Standards Institute
IEC	International Electrotechnical Commission
EMI	Electromagnetic interference

Device Description

This section describes the physical characteristics, controls, and indicators of the Battery Support System 2 (BSS 2), LIFEPAK NiCd, LIFEPAK SLA, FASTPAK NiCd and FASTPAK 2 NiCd batteries. This section also provides a theory of operation (input signals, assembly functions, and device outputs).

Introduction

Physical Description and Features

Naming Conventions and Status Indications

FASTPAK and LIFEPAK Batteries

Functional Description

Introduction

The PHYSIO-CONTROL BSS 2 is a microprocessor-controlled battery charging, testing, and conditioning system with three battery wells that operate independently of each other. Each battery well can charge, shelf life test, or condition Physio-Control FASTPAK, FASTPAK 2, LIFEPAK NiCd, or LIFEPAK SLA batteries. Batteries can be installed or removed from a battery well while batteries in other wells are being serviced.

The FASTPAK 2, LIFEPAK NiCd and LIFEPAK SLA batteries contain a battery management IC that communicates with the BSS 2 to automatically control charging, conditioning, or testing.

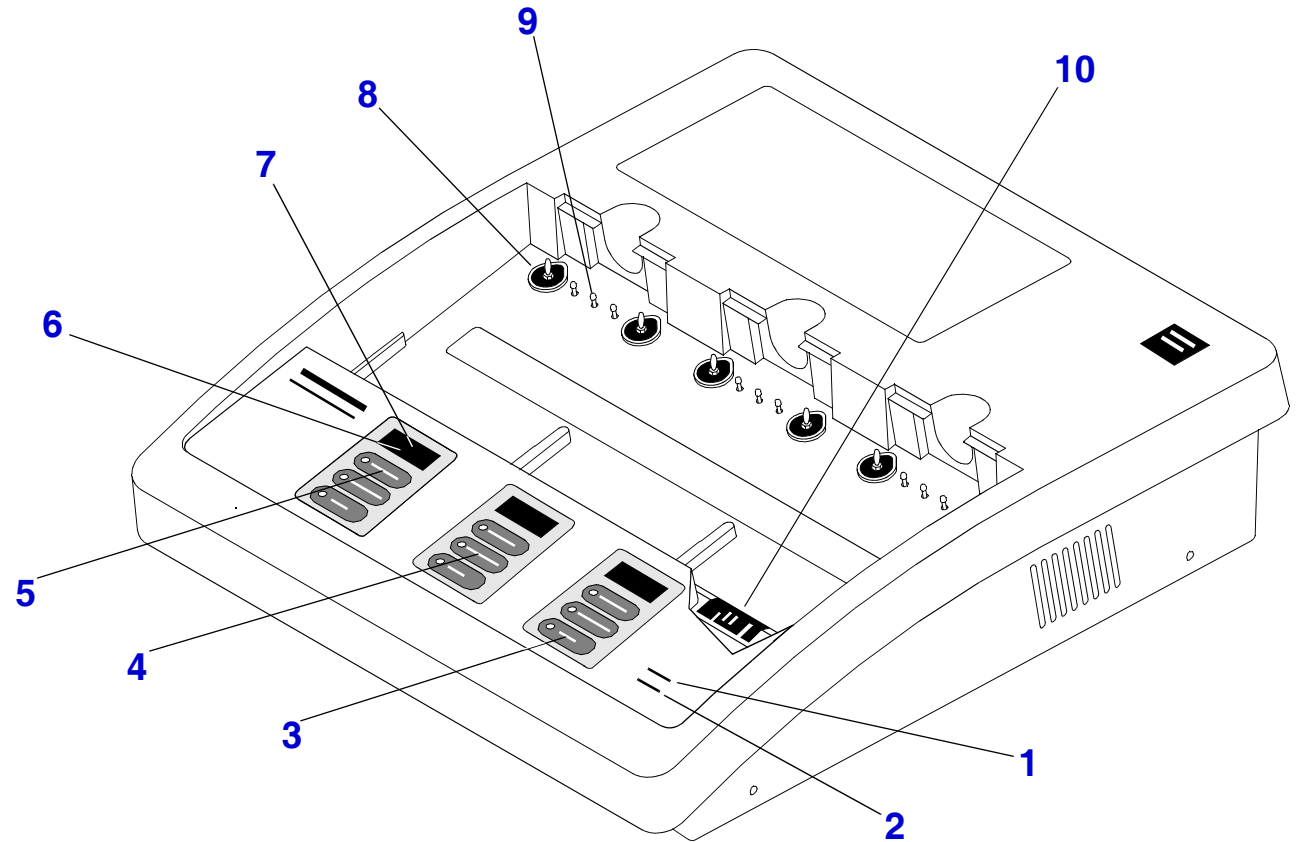
A three-push-button panel (CHARGE, CONDITION, SHELF LIFE) below each battery well allows the operator to select the desired type of battery service. In addition, each panel contains a lighted display that clearly indicates whether a battery is charging, ready for use, or needs to be discarded.

The BSS 2 operates on ac power only through a detachable power cord.

Physical Description and Features

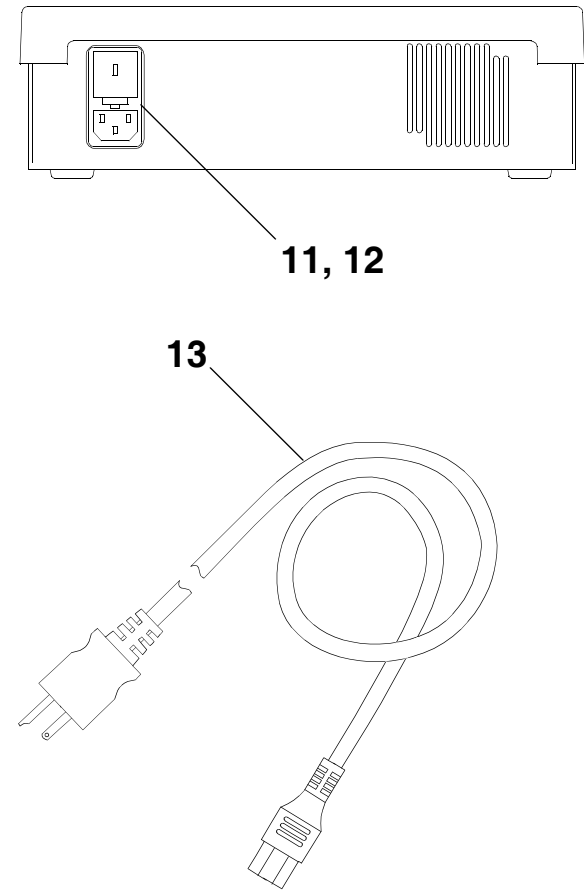
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Click on a number for information on any of the numbered BSS 2 controls, indicators, and connectors shown below.



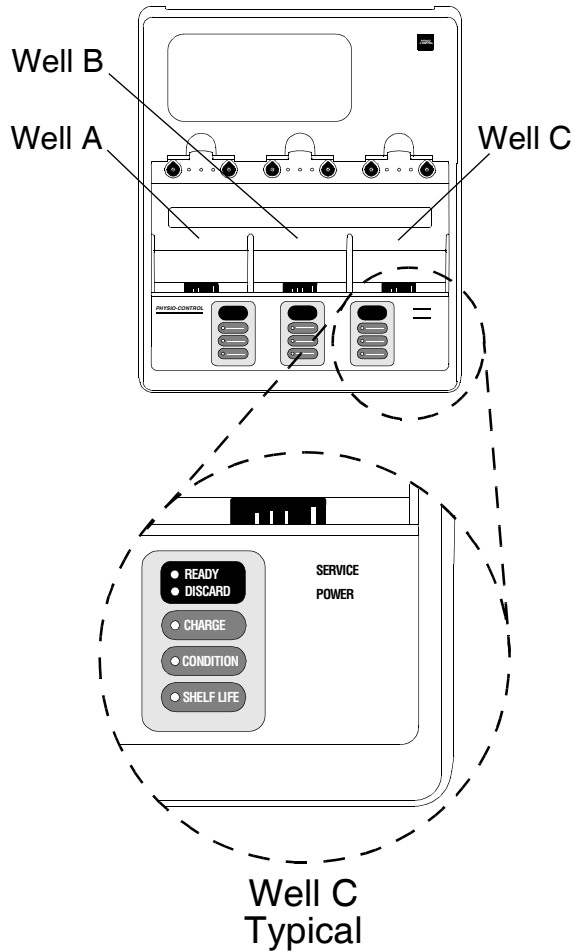
Physical Description and Features

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Number	Description
1	SERVICE: (Red) Indicates BSS 2 needs service when on steady.
2	POWER: (Green) Indicates power is on.
3	SHELF LIFE: (Amber) Indicates battery is undergoing a shelf life test.
4	CONDITION: (Amber) Indicates battery is conditioning.
5	CHARGE: (Amber) Indicates battery is charging.
6	DISCARD: Indicates battery should be removed from use and discarded/recycled. May also indicate short between communication pins or contact blades.
7	READY: Indicates battery is ready for use.
8	+/- Battery Terminals: Transfer charge current onto battery.
9	Pogo Pins: Provide digital communication between BSS 2 and the FASTPAK 2 battery.
10	Contact Blades: Provide digital communication between BSS 2 and the LIFEPAK NiCd, or LIFEPAK SLA battery.
11	AC Power Input Receptacle: Receptacle for ac power cord.
12	Fuses: Two fuses help protect the BSS 2 from current surges.
13	Power Cord: Cable for operation from an ac outlet.

Naming Conventions and Status Indicators



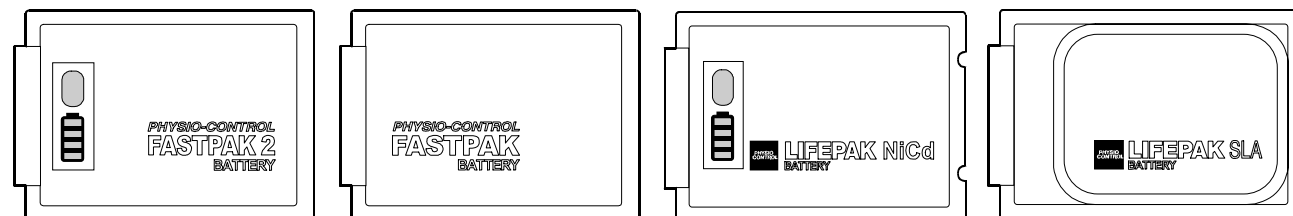
Battery well names and indicators are defined in the figure at left and table below.

The LED indications table summarizes the meaning of each front panel LED with various flashing patterns. An LED will be in one of the following states: Off, On, Flashing. Only one LED per battery well is illuminated at any given time.

LED Indications

Well	LED	Pattern	Meaning
	POWER	Always on solid	BSS 2 powered on
	SERVICE	On solid	Failed Power-on self-test
	SERVICE	Flashing	Performance Inspection Mode
A, B, or C	READY	On solid	Passed the selected test
A, B, or C	DISCARD	On solid	Failed the selected test
A, B, or C	CHARGE, CONDITION, SHELF LIFE	Flashing	Test Number Entry Mode
A, B, or C	CHARGE, CONDITION, SHELF LIFE	On solid	Test in progress

FASTPAK and LIFEPAK Batteries



FASTPAK 2 battery
PN 3009375

FASTPAK battery
PN 9-10424-19 (gold)
PN 9-10424-18 (white)

LIFEPAK NiCd battery
PN 3009376

LIFEPAK SLA battery
PN 3009378

The FASTPAK, FASTPAK 2, and LIFEPAK NiCd batteries have a nickel cadmium (NiCd) chemistry and the LIFEPAK SLA battery has a sealed-lead acid (SLA) chemistry. The LIFEPAK NiCd battery has the same features as the FASTPAK 2, but with increased capacity. The FASTPAK and FASTPAK 2 batteries can be used interchangeably. The FASTPAK 2 and LIFEPAK NiCd batteries have a charge level indicator (fuel gauge) and special circuitry that allow them to communicate with the BSS 2. The LIFEPAK SLA battery also communicates with the BSS2, but does not have a fuel gauge.

The LIFEPAK batteries can be used only in the LIFEPAK 12 defibrillator/monitor series.

Functional Description

The BSS 2 is a line-powered battery maintenance system used for Physio-Control FASTPAK, FASTPAK 2, LIFEPAK NiCd, and LIFEPAK SLA batteries. The BSS 2 consists of the following components:

- Chassis – A formed metal enclosure that houses the following lower case components:
 - Main PCB – A printed circuit board that controls all operational modes, including battery charge and discharge, shelf life test, battery condition protocols, and performance tests. There are no field repairable components on the Main PCB.
 - Power Entry Module – An ac line power input connector containing input fuses and a line voltage selector. Used with a detachable power cord for connection to local line power receptacles.
 - Fan Assembly – An exhaust fan designed to operate intermittently under Main PCB microprocessor control for cooling the device when internal temperatures rise too high.
 - Transformer Assembly – An ac line power step-down transformer.

Functional Description

- Keypad – A membrane switch assembly that provides facilities for user control inputs to, and status indications for three identical battery wells. Separate indicators illuminate when the device is connected to line power and when internal test routines detect errors requiring service.
- Contact Block PCBs – Connector assemblies for passing communications between LIFEPAK NiCd, and LIFEPAK SLA batteries and the BSS 2. Each Contact Block PCB contains three blade-like contacts. There are three Contact Block PCBs in the BSS 2.
- Pogo Pins – Spring-loaded contact posts for passing communications between FASTPAK 2 batteries and the BSS 2. There are a total of nine pogo pins installed, three in each battery well.

Note: Depending upon the battery type installed, the BSS 2 uses either the pogo pins or the Contact Block PCB for communication with batteries.

- Battery Pins – Miniature banana pin contacts carry charge and discharge currents to batteries installed in the BSS 2. Each battery well is outfitted with a positive (+) and negative (-) battery pin.

Note: Battery pins and pogo pins require periodic replacement. See [Battery Pin Replacement](#) and [Pogo Pin Replacement](#) for instructions.

Functional Description

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- Wiring Harnesses – Interconnections within the BSS 2 are made using a combination of discrete wires and ribbon cables. There are no field repairable wire harness components.

Note: See the [Interconnect Diagram](#) for details showing wiring connections made between the system components.

Operating Instructions

This section describes the basic operation of the Battery Support System 2 (BSS 2). It is not intended as a user manual. For complete operating instructions, refer to the [Battery Support System 2 Operating Instructions](#).

This section describes:

Battery Insertion and Removal

Battery Charging

Battery Conditioning

Shelf Life Testing

Battery Insertion and Removal

CAUTION!

Possible equipment damage. Battery pins in the battery support system may be damaged if the batteries are dropped or forced into the battery wells. Inspect the battery pins routinely for signs of damage.

Routinely inspect batteries for damage or leakage. Discard/recycle damaged or leaking batteries. To insert a battery into a battery well:

1. Inspect the +/- terminals (pins) in the battery well for signs of damage.
2. Inspect the battery well for signs of damage or distortion.
3. Align the battery so that the battery clip is over the pins in the battery well.
4. Insert the end of the battery opposite the battery clip into the battery well.
5. Firmly press the other end into the battery well until it clicks into place.
6. To remove the battery, press the battery clip in and lift the battery out of the battery well.

Battery Charging

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CAUTIONS!

Possible battery damage. Charging batteries at temperatures below 5°C (41°F) or above 35°C (95°F) prevents the battery from reaching full capacity and may cause irreversible cell damage.

Possible battery damage. If SLA batteries are not 100% recharged between uses, sulfate deposits can build up on electrode surfaces inside the battery. Sulfation reduces battery capacity and may result in premature battery failure.

Batteries begin charging automatically when inserted into a battery well. The amber CHARGE LED lights during the charge cycle.

Battery Charging

Page 2 of 2

When a battery reaches full charge, the green READY indicator lights. The battery may remain in the battery well until needed. The BSS 2 supplies a trickle charge that prevents the battery from overcharging and maintains the battery at peak capacity.

Note: When a battery in need of conditioning is placed in a battery well, conditioning begins automatically (CONDITION lights). The conditioning cycle includes a full battery recharge. When the battery is fully charged, READY lights.

Note: If DISCARD lights, remove the battery from use and **discard/recycle**.

Battery Conditioning

Conditioning is a series of charge/deep discharge cycles performed to measure and optimize battery capacity. Batteries should be conditioned every 3 months.

To condition a battery:

1. Insert a battery into a battery well. **CONDITION** lights automatically when a FASTPAK 2 or LIFEPAK NiCd battery requires conditioning. Allow the FASTPAK 2 or LIFEPAK NiCd to complete the conditioning cycle.
2. FASTPAK batteries must be conditioned manually - Insert the FASTPAK battery into a battery well and press condition.
3. The BSS 2 automatically recharges a battery that successfully completes the conditioning process. **READY** lights when a battery is fully recharged.

Note: If **DISCARD** lights, remove the battery from use and **discard/recycle**.

Note: LIFEPAK SLA batteries do not require routine maintenance as NiCd batteries do. The condition mode may be used to test LIFEPAK SLA performance, or to determine if a battery is viable.

Note: If a power failure occurs during conditioning, the BSS 2 interrupts conditioning. For FASTPAK 2, LIFEPAK NiCd, and LIFEPAK SLA batteries, the conditioning cycle begins automatically after power is restored. For FASTPAK batteries, it is necessary to restart the conditioning process manually.

Shelf Life Testing

Batteries self-discharge when not in use. A new NiCd battery self-discharges approximately 1% of its capacity every day when stored at room temperature. In 10 days, a new NiCd battery loses approximately 10% of its capacity.

SLA batteries have a low self-discharge rate. A new SLA battery self-discharges approximately 0.1% of its capacity each day when stored at room temperature. In 10 days, a new SLA battery loses approximately 1.0% of its capacity.

The actual rate of battery self-discharge depends on:

- Battery age
- Temperature
- Frequency of use
- Length of time in storage
- Physical condition

These factors can combine to significantly increase the battery discharge rate. For example, an older NiCd battery stored at higher temperatures may have an accelerated self-discharge rate much greater than 1% per day. The self-discharge rate increases as the battery ages.

The shelf life test evaluates the self-discharge rate of a stored battery. Any battery that fails the shelf life test (**DISCARD** lights) should be removed from use and **discarded/recycled**.

Shelf Life Testing

Page 2 of 3

Batteries should be shelf life tested every six months. To perform a shelf life test:

1. Complete the **conditioning** procedure.
2. Remove the battery from the BSS 2 and store, open-circuited, for 7 days at room temperature.
3. After storage, insert the battery into a battery well and press `SHELF LIFE` within 3 seconds.
4. Verify that `SHELF LIFE` lights.
5. `READY` lights when the battery passes the shelf life test and is fully recharged. The battery may then be returned to use.

Note: If `DISCARD` lights, remove the battery from use and **discard/recycle**.

Note: If a power failure occurs during shelf life test, the BSS 2 interrupts the shelf life test and reverts to `CHARGE` Mode once power is restored. The shelf life test may not have been completed. Repeat the shelf life test.

Shelf Life Testing

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NiCd batteries (FASTPAK, FASTPAK 2, or LIFEPAK NiCd) may exhibit an increased self discharge rate during the first 24 hours after charging. At room temperature (68°F), the capacity may be reduced by as much as 5% during this 24 hour period. At higher ambient temperatures, a battery may discharge by as much as 22% during this period. It is therefore very important to charge and maintain batteries in a room temperature environment.

FASTPAK 2 and LIFEPAK NiCd batteries may manifest this charge reduction by extinguishing one to two “bars” (lights) on their fuel gauge display after 24-48 hours. It is important to remember that the fuel gauge on these batteries provides a *conservative* indication of battery capacity: there will always be more capacity available than the fuel gauge indicates.

Modes of Operation

The Modes of Operation section explains the operating and test modes of the Battery Support System 2 (BSS 2). Each battery well has six operational modes: Standby, Charge, Condition, Shelf Life, Ready, and Discard. With the exception of Standby Mode (no LED), each operational mode has a corresponding LED. In addition, the BSS 2 has three test modes: Power Up (self testing), Field Test, and Test Number Entry Mode (service personnel testing).

Standby Mode

Charge Mode

Condition Mode

Shelf Life Test Mode

Ready Mode

Discard Mode

Performance Inspection Mode

Test Number Entry Mode

Standby Mode

When the BSS 2 ac power cord is inserted into an ac power receptacle, the BSS 2 performs a series of self-diagnostic tests. Power-up testing is indicated by all the LEDs briefly illuminating. If self-testing is successful, all the LEDs (except POWER) extinguish.

If the BSS 2 fails any power-up self-test, the BSS 2 disables its functions and the SERVICE indicator lights. Remove the BSS 2 from use and investigate and repair any malfunctions.

Standby Mode is the “wait state” for a battery well when the BSS 2 is powered on but a battery is not installed. A battery well automatically goes into standby mode when a battery is removed from a battery well. Pressing CHARGE, CONDITION, or SHELF LIFE is ignored in Standby Mode.

Charge Mode

Charge Mode fully recharges a battery in two sequential stages: a relatively short duration Fast Charge stage followed either by a Trickle Charge stage (for NiCd batteries) or Float Charge stage (for SLA batteries). When the battery is fully charged, **READY** lights. If a battery cannot be recharged, **DISCARD** lights and discard/recycling is recommended.

Charge Mode is the default mode for a battery well. Charge Mode is initiated in one of three ways:

- By installing a FASTPAK or LIFEPAK SLA battery into a battery well.
- By installing a FASTPAK 2 or LIFEPAK NiCd battery (not currently in need of conditioning).
- By pressing **CHARGE** when a battery is in **Condition Mode** or **Shelf Life Mode**.

To exit Charge Mode, either remove the battery from the BSS2 or press **CONDITION**.

Condition Mode

Battery Conditioning Times:

FASTPAK: 7–8 hrs

FASTPAK 2: 7–8 hrs

LIFEPAK NiCd: 7–8 hrs

(1.7 A/H)

LIFEPAK SLA: 9–11 hrs

(2.4 A/H)*

Battery conditioning comprises charging, discharging, and capacity measurement. In Condition Mode, the BSS 2 performs three functions. It assesses internal battery impedance and measures/optimizes battery capacity. After the conditioning cycle is complete, the BSS 2 automatically recharges the battery. When fully charged, **READY** lights. However, if a battery fails conditioning, **DISCARD** lights and discarding/recycling is recommended.

A battery fails Condition Mode if:

- It cannot attain a predetermined minimal capacity.
- The internal impedance is too high.

To select Condition Mode either:

- FASTPAK batteries - Press **CONDITION** to initiate a condition cycle.
- FASTPAK 2 and LIFEPAK NiCd batteries - Conditioning is automatic on a 90 day cycle. To initiate conditioning manually, press **CONDITION**.
- * LIFEPAK SLA batteries - Do not require routine conditioning. A condition cycle may be initiated manually (by pressing **CONDITION**) to test LIFEPAK SLA performance, or to determine if a battery is usable.

To exit Condition Mode either:

- Remove the battery from the battery well.
- OR-
- Press **CHARGE**.

Shelf Life Test Mode

Note: Before beginning Shelf Life Test Mode a battery must first undergo a Conditioning cycle followed by a 7- to 8-day open-circuit rest.

Use Shelf Life Test Mode to evaluate the self-discharge rate of a battery. At the end of a successful Shelf Life Test, the BSS 2 automatically recharges the battery undergoing test. When the battery is fully charged, **READY** lights. If a battery cannot retain a predetermined minimal capacity after Shelf Life Testing, **DISCARD** lights and discarding/recycling is recommended.

To enter Shelf Life Test Mode:

- Install a battery into a battery well.
- Press **SHELF LIFE** within 3 seconds of battery insertion.

Shelf Life Test Mode cannot be entered from Charge, Condition, Ready, or Discard Modes.

To exit Shelf Life Test Mode either:

- Remove the battery from the battery well.
- OR-
- Press **CHARGE** or **CONDITION**.

Ready Mode

Ready Mode indicates that a battery has successfully completed Charge, Condition, or Shelf Life Test Mode, is fully charged, and is ready for use. In Ready Mode, batteries are maintained in a fully charged state. Batteries can remain in the BSS 2 indefinitely. During Ready Mode, the BSS 2 performs an automatic battery maintenance cycle of trickle charge/discharge/condition.

Ready Mode is not user-selectable. A battery well enters Ready Mode automatically by means of internal BSS 2 processing. When a battery is in Ready Mode, pressing CHARGE, CONDITION, or SHELF LIFE is ignored.

To exit Ready Mode, remove the battery.

Discard Mode

WARNING!

Possible loss of power during patient care. Use of a battery subsequent to the discard advisory may cause power failure without warning. Do not use a battery for which a discard advisory has been rendered.

Discard Mode indicates that a battery has failed Charge, Condition, or Shelf Life Test and should be discarded/recycled.

When a battery is in Discard Mode, pressing CHARGE, CONDITION, or SHELF LIFE is ignored.

Discard Mode is not user-selectable. A battery well enters Discard Mode automatically by means of internal BSS 2 processing.

To exit Discard Mode, remove the battery.

Performance Inspection Mode

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Summary of Available Tests

Performance Inspection Mode allows closed-case diagnostic testing of the BSS 2. Nine diagnostic tests are available. In addition, the first five entries of the BSS 2 Event Log can be displayed and cleared.

- **LED Test** — The BSS 2 lights all the LEDs in a predetermined sequence.
- **Keypad Test** — All nine keys on the front panel must be pressed in a prescribed sequence. Keypad Test also serves as the password to enter Test Number Entry Mode.
- **Fan Test** — The BSS 2 turns on the fan.
- **FASTPAK 2/LIFEPAK NiCd/LIFEPAK SLA I²C Battery Test** — The BSS 2 sends a predetermined message to the FASTPAK 2/LIFEPAK NiCd/LIFEPAK SLA battery and waits for a response. The response is compared to an internally stored reference.
- **Thermistor Test** — The BSS 2 verifies that a FASTPAK 2/LIFEPAK NiCd/LIFEPAK SLA battery's thermistor is within valid limits.

The next four test results are measured with a DMM:

- **Charge Test** — The BSS 2 initiates a charge current at two predetermined current levels.
- **Discharge Test** — The BSS 2 initiates a discharge current at two predetermined current levels.

Performance Inspection Mode

Page 2 of 4

Summary of Available Tests (continued)

- **High Current Discharge Test** — The BSS 2 discharges a battery at 6 amps for 15 seconds.
- **Voltage Measurement Test** — An external voltage reference is applied to the battery terminals and the voltage reading is compared to stored limits.

While in **Performance Inspection Mode**, the first five BSS 2 **Event Codes** may be displayed on the front panel LEDs. Event Codes must be thoroughly investigated and resolved prior to returning the BSS 2 to active use (see **Troubleshooting**).

Performance Inspection Mode

Page 3 of 4

Entering Performance Inspection Mode

To enter Performance Inspection Mode:

1. Unplug the BSS 2 from ac line power.
2. Press and hold **B-SHELF LIFE** and **C-SHELF LIFE** while connecting the BSS 2 to ac line power.
3. The BSS 2 enters power-up self-test mode during which the front panel LEDs for all three light in the following sequence:
 - A-, B-, C-, SHELF LIFE
 - A-, B-, C-, CONDITION
 - A-, B-, C-, CHARGE
 - A-, B-, C-, DISCARD
 - A-, B-, C-, READY
4. Upon completion of power-up self test, the BSS 2 will either:
 - Illuminate the **SERVICE** legend steadily in the event of a self test failure, or
 - Flash the **SERVICE** legend indicating successful completion of self test.

Performance Inspection Mode

Entering Performance Inspection Mode (continued)

5. Within seconds of the self test completion, enter the Performance Inspection Mode Keypad Test passcode by pressing the front panel keys in the following order:

Well A		Well B		Well C	
1	Charge	4	Charge	7	Charge
2	Condition	5	Condition	8	Condition
3	Shelf Test	6	Shelf Test	9	Shelf Test

Note: During passcode entry the LED associated with each key illuminates coincident with the key press.

Note: Upon successful passcode entry, the BSS 2 momentarily illuminates all three READY legends. Then the BSS 2 continuously flashes all three CHARGE LEDs: a state defined as **Test Number Entry Mode**.

Refer to **Summary of Test Numbers and Test Result Indications** for a summary of tests, their corresponding test numbers, and test result indications.

Test Number Entry Mode

Each Performance Inspection test is identified by a unique three-digit number corresponding to the three LEDs on the keypad (see table below). Each test number digit has a value between 0 and 3. Note that “1” corresponds to the bottom row of the keypad, “2” to the second row, and “3” to the third row.

Keypad Entry of Test Number Digits

Well A LED	First Digit	Well B LED	Second Digit	Well C LED	Third Digit
CHARGE	3	CHARGE	3	CHARGE	3
CONDITION	2	CONDITION	2	CONDITION	2
SHELF LIFE	1	SHELF LIFE	1	SHELF LIFE	1
None	0	None	0	None	0

Test Number Entry Mode

The default test number is “333” (all three CHARGE LEDs flashing).

When the desired test number is displayed, press the **ENTER** key to save the selection. Once a test number is entered, the **ON** LED stops flashing and stays on solid while the test is in progress or until the **EXIT** key is pressed. The table below contains key assignments for scrolling up or down and entering or exiting a test number.

Key Assignments for Scrolling and Confirming Test Number

Well A Key	First Digit	Well B Key	Second Digit	Well C Key	Third Digit
CHARGE	UP	CHARGE	UP	CHARGE	UP
CONDITION	DOWN	CONDITION	DOWN	CONDITION	DOWN
SHELF LIFE		SHELF LIFE	EXIT	SHELF LIFE	ENTER

Test Number Entry Mode

Page 3 of 6

When a test requires the use of external test equipment (DMM and/or batteries), the BSS 2 waits for 15 seconds (maximum) after the user presses **ENTER** for the equipment to be connected. After 15 seconds, the test terminates and **DISCARD** lights.

A test can be terminated at any time by pressing the **EXIT** key.

After completing a test, press **EXIT** to return to Test Number Entry Mode.

Test Number Entry Mode

Test Numbers and Test Result Indications

Refer to the table below for test numbers and test result indications.

Summary of test numbers and test result indications

Test	Well	Test Number	Option	Indication (Passed)	Indication (Failed)
Read Event Log		101	1st Entry	none	none
		102	2nd Entry	none	none
		103	3rd Entry	none	none
		111	4th Entry	none	none
		112	5th Entry	none	none
Clear Event Log		113		A-READY, B-READY, C-READY	A-DISCARD, B-DISCARD, C-DISCARD
FASTPAK 2/ LIFEPAK SLA I ² C Test	A	121		A-READY	A-DISCARD
	B	122		B-READY	B-DISCARD
	C	123		C-READY	C-DISCARD
Thermistor Test	A	131		A-READY	A-DISCARD
	B	132		B-READY	B-DISCARD
	C	133		C-READY	C-DISCARD

Test Number Entry Mode

Test Numbers and Test Result Indications (continued)

Summary of test numbers and test result indications (continued)

Test	Well	Test Number	Option	Indication (Passed)	Indication (Failed)
Charge Test ¹	A	201	200 ma	A-READY	A-DISCARD
		211	1200 ma	A-READY	A-DISCARD
	B	202	200 ma	B-READY	B-DISCARD
		212	1200 ma	B-READY	B-DISCARD
	C	203	200 ma	C-READY	C-DISCARD
		213	1200 ma	C-READY	C-DISCARD
Discharge Test ¹	A	221	200 ma	A-READY	A-DISCARD
		231	1200 ma	A-READY	A-DISCARD
	B	222	200 ma	B-READY	B-DISCARD
		232	1200 ma	B-READY	B-DISCARD
	C	223	200 ma	C-READY	C-DISCARD
		233	1200 ma	C-READY	C-DISCARD

Test Number Entry Mode

Test Numbers and Test Result Indications (continued)

Summary of test numbers and test result indications (continued)

Test	Well	Test Number	Option	Indication (Passed)	Indication (Failed)
High Current Discharge Test ¹	A	301	6 a	A-READY	A-DISCARD
	B	302	6 a	B-READY	B-DISCARD
	C	303	6 a	C-READY	C-DISCARD
Voltage Measurement Test ¹	A	311	4.0 v	A-READY	A-DISCARD
		321	15.6 v	B-READY	B-DISCARD
	B	312	4.0 v	C-READY	C-DISCARD
		322	15.6 v	A-READY	A-DISCARD
	C	313	4.0 v	B-READY	B-DISCARD
		323	15.6 v	C-READY	C-DISCARD
Fan Test		331		visual/other	visual/other
LED Test		332		All LEDs light in proper sequence	Any LED not lighting
Keypad Test		333		A-READY, B-READY, C-READY	A-DISCARD, B-DISCARD, C-DISCARD

¹ Requires external meter reading

Performance Inspection Procedure

The Performance Inspection Procedure (PIP) is a set of test procedures used for an operational closed-case evaluation of the Battery Support System 2 (BSS 2) to determine if the BSS 2 is operating within the required specifications. Investigate and correct any malfunctions or out-of-tolerance conditions detected during the PIP.

Perform the PIP as part of a regularly scheduled preventive maintenance routine. Also, perform the PIP after any repair, replacement, or calibration procedure. Print the **PIP Checklist** to record the results.

PIP – Scope and Applicability

PIP – Resource Requirements

PIP – Test Equipment Requirements

PIP – Instructions

PIP – Checklist

PIP – Scope and Applicability

The PIP applies to the Physio-Control BSS 2 exclusively.

To complete the PIP, perform all tests from start to finish, in the order presented in the [PIP – Instructions](#) section of this Service Manual.

Refer to the [PIP – Resource Requirements](#) for a listing of the necessary qualifications for PIP equipment, test equipment verification, workstation power, and personnel.

Refer to the [PIP – Test Equipment Requirements](#) for a listing of test equipment, including specifications, required to complete the PIP.

You can print the [PIP – Checklist](#) and use it to record your results.

PIP – Resource Requirements

This section describes the requirements for PIP equipment, PIP test equipment verification, PIP workstation power, and PIP personnel.

PIP – Equipment

To perform the PIP, you must use the equipment listed in the [PIP – Test Equipment Requirements](#) table. Although the table lists specific test equipment by manufacturer, test equipment with equivalent specifications may be substituted.

PIP – Test Equipment Verification

All test equipment used to perform the PIP must have a current calibration label. The calibration label must be issued by a certified calibration facility.

PIP – Workstation Power

The ac line power to the workstation used must be connected to a grounded power source.

PIP – Personnel

Service personnel who perform the PIP must be thoroughly familiar with the operation of the BSS 2 and must meet the requirements described in [Service Personnel Qualifications](#).

PIP – Test Equipment Requirements

The following table contains a list of equipment required to perform the PIP:

Equipment	Specifications	Manufacturer
FASTPAK 2, LIFEPAK NiCd battery	NiCd battery with fuel gauge	Medtronic Physio-Control PN 3009375 or: Medtronic Physio-Control PN 3009376
LIFEPAK SLA battery	SLA battery	Medtronic Physio-Control PN 3009378
Power supply	0 – 20 v variable	Topward TPS 2000 or equivalent
Digital multimeter (DMM)	3½ digits, 10 a +0.5% of reading, +1 digit Resolution 10 ma	Fluke 8010A, or equivalent
Safety analyzer	Line voltage: 110 or 220 vac Current range: 0 – 1999 µa	Dale 600/600E (Dale Technology, Inc.)

PIP – Instructions

Page 1 of 22

PIP – General Instructions

This section lists the general instructions for performing the Performance Inspection Procedure (PIP).

- Perform the PIP in the presented order.
- Always start the PIP from the beginning of the procedure.
- Print the [PIP Checklist](#) and record your results.
- See [Troubleshooting](#) to correct failures, then repeat the PIP.

PIP – Instructions

Page 2 of 22

PIP – Exterior Physical Inspection

To perform an exterior physical inspection:

1. Inspect all exterior surfaces of the Unit Under Test (UUT) and accessories for the following:
 - Damage
 - Excessive wear
 - Improper mechanical function
 - Damaged connectors
2. Pick up and turn over the UUT and listen for loose or rattling hardware. Locate any loose or rattling hardware and tighten or replace it.
3. Check the UUT for general cleanliness. Remove debris, dust, foreign objects, and/or other contaminants.

PIP – Instructions

Page 3 of 22

PIP – Physical Inspection (continued)

4. Inspect the rubber feet on the underside of the lower enclosure. Reinstall or replace rubber feet as necessary.
5. Inspect the battery connector pins for the following:
 - Tighten loose pins.
 - Examine each leaf on the connector pins to make sure it is not cracked or broken.
 - Replace bent, broken, corroded, worn, or damaged pins using the [Battery Pin Replacement](#) procedure.
6. Inspect the smart battery pogo pins for the following:
 - Verify the pin has free range of motion and spring action.
 - Replace bent, broken, corroded, worn, or damaged pogo pins using the [Pogo Pin Replacement](#) procedure.
7. Inspect the keypanels and overlays for damage, cracks, or separations.
8. Record the results in the PIP Checklist.

PIP – Instructions

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PIP – Power On/Self Test

To perform the Power On/Self Test:

1. Connect the UUT to ac line power.
2. Verify the front panel LEDs illuminate in the following sequence:
 - A, B, and C SHELF LIFE
 - A, B, and C CONDITION
 - A, B, and C CHARGE
 - A, B, and C DISCARD
 - A, B, and C READY
 - SERVICE illuminates steadily throughout the self test
 - All LEDs turn off, including SERVICE
3. Verify the SERVICE legend is off.
4. Unplug the UUT from ac line power.
5. Record the results in the PIP Checklist.

PIP – Instructions

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PIP – Keypad Test

To perform the Keypad Test:

1. Unplug the BSS 2 from ac line power.
2. Press and hold **B-SHELF LIFE** and **C-SHELF LIFE** while connecting the BSS 2 to ac line power.
3. The BSS 2 enters power-up self-test mode during which the front panel LEDs for all three light in the following sequence:
 - A-, B-, C-, SHELF LIFE
 - A-, B-, C-, CONDITION
 - A-, B-, C-, CHARGE
 - A-, B-, C-, DISCARD
 - A-, B-, C-, READY
4. Upon completion of power-up self test, the BSS 2 will either:
 - Illuminate the **SERVICE** legend steadily in the event of a self test failure, or
 - Flash the **SERVICE** legend indicating successful completion of self test.

PIP – Instructions

PIP – Keypad Test (continued)

5. Within seconds of the self test completion, enter the Performance Inspection Mode Keypad Test passcode by pressing the front panel keys in the following order:

Well A		Well B		Well C	
1	Charge	4	Charge	7	Charge
2	Condition	5	Condition	8	Condition
3	Shelf Test	6	Shelf Test	9	Shelf Test

- Note:** Upon successful passcode entry, the UUT momentarily illuminates all three Ready legends. Then, the UUT continuously flashes all three Charge LEDs: a state defined as **Test Number Entry Mode**. Failure to enter the password in the correct sequence or within 15 seconds causes the A, B, and C DISCARD LEDs to illuminate, indicating a failure. To re-enter the passcode, unplug the UUT and wait two seconds. Then repeat the the steps to enter Performance Inspection Mode.
6. Verify each key responds to normal key pressure by illuminating the corresponding LED.
7. Record the results in the PIP Checklist.
8. Continue to the next test while in Performance Inspection Mode.

PIP – Instructions

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PIP – Fan Test

Note: To enter the test numbers in this procedure you must scroll to the desired digits by repeatedly pressing **CHARGE** (scroll up) or **CONDITION** (scroll down).

To perform the Fan Test:

1. Enter the Fan Test Number 331 (**A-CHARGE**, **B-CHARGE**, **C-SHELF LIFE**).
2. Press the **ENTER** key (**C-SHELF LIFE**) to begin the Fan Test.
3. Verify the fan turns on and removes air from the UUT.
4. To exit the Fan Test, press the **EXIT** key (**B-SHELF LIFE**).
5. Record the results in the PIP Checklist.
6. Continue on to the next test while in Performance Inspection Mode.

PIP – Thermistor Test

The Thermistor Test verifies the UUT capability to detect thermistors installed in FASTPAK 2, LIFEPAK NiCd, and LIFEPAK SLA batteries. Each battery well must be tested individually.

To perform the Thermistor Test:

1. Enter the Thermistor Test Number 131 (**A-SHELF LIFE**, **B-CHARGE**, **C-SHELF LIFE**) for battery Well A.

PIP – Instructions

PIP – Thermistor Test (continued)

2. Install a FASTPAK 2, LIFEPAK NiCd, or LIFEPAK SLA battery.
3. Press the **ENTER** key (**C-SHELF LIFE**) to begin the Thermistor Test.
4. Verify that **A-READY** lights within 15 seconds.

Note: If **DISCARD** illuminates, this may indicate a failure of the UUT or the subject test battery. Repeat the test with another FASTPAK 2/LIFEPAK NiCd/LIFEPAK SLA battery to confirm whether the malfunction is within the UUT or the original battery.

5. To exit the test, press the **EXIT** key (**B-SHELF LIFE**) and remove the battery.
6. Repeat steps 1 through 5 for battery Well B using test number 132 (**A-SHELF LIFE**, **B-CHARGE**, **C-CONDITION**).
7. Repeat steps 1 through 5 for battery Well C using test number 133 (**A-SHELF LIFE**, **B-CHARGE**, **C-CHARGE**).
8. Record the results in the PIP Checklist.
9. Continue to the next test while in Performance Inspection Mode.

PIP – Instructions

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PIP – FASTPAK 2/ LIFEPAK NiCd/ LIFEPAK SLA I²C Test

The FASTPAK 2/LIFEPAK NiCd/LIFEPAK SLA I²C Test verifies the UUT capability to communicate with the batteries via the I²C bus. Each battery well must be tested individually. To perform the FASTPAK 2/LIFEPAK NiCd/LIFEPAK SLA I²C Test:

1. Enter the FASTPAK 2/LIFEPAK NiCd/LIFEPAK SLA I²C Test Number 121 (A-SHELF LIFE, B-CONDITION, C-SHELF LIFE) for battery Well A.
2. Install a FASTPAK 2, LIFEPAK NiCd, or LIFEPAK SLA battery in Well A.
3. Press the **ENTER** key (C-SHELF LIFE) to begin the test.
4. Verify that A-READY lights within 15 seconds.

Note: If DISCARD illuminates, this may indicate a failure of the UUT or the subject test battery. Repeat the test with another battery to confirm whether the malfunction is within the UUT or the original battery.

5. To exit, press the **EXIT** key (B-SHELF LIFE) and remove the battery.
6. Repeat steps 1 through 5 for battery Well B using test number 122 (A-SHELF LIFE, B-CONDITION, C-CONDITION).

PIP – Instructions

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PIP – FASTPAK 2/ LIFEPAK NiCd/ LIFEPAK SLA I²C Test (continued)

7. Repeat steps 1 through 5 for battery Well C using test number 123 (A-SHELF LIFE, B-CONDITION, C-CHARGE).
8. Record the results in the PIP Checklist.
9. Continue to the next test while in Performance Inspection Mode.

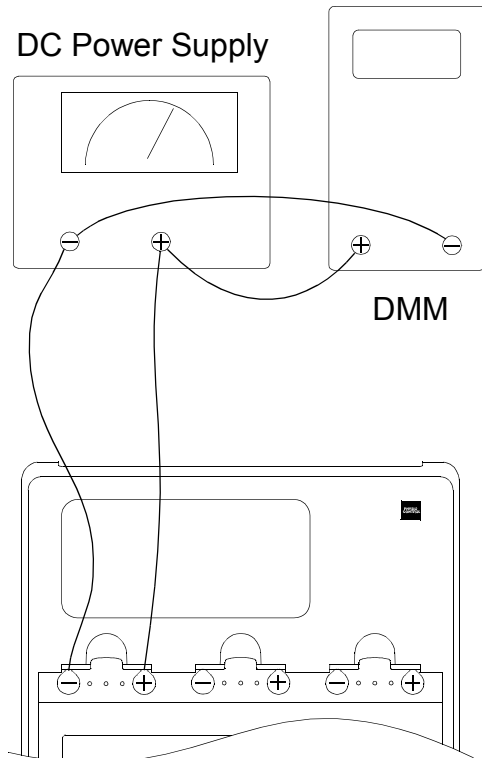
PIP – Instructions

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PIP – Voltage Measurement Test

The Voltage Measurement Test verifies the UUT capability to measure the terminal voltage of batteries installed for purposes of charge, conditioning, or shelf life test at two discrete levels. Each battery well must be individually tested. To perform the Voltage Measurement Test:

1. Establish the test setup shown at the left. Be sure to properly connect the power supply positive (+) terminal to the UUT positive (+) battery pin.
Note: A reversed polarity connection between the power supply and the UUT causes `DISCARD` to light. Check the setup and try the test again.
2. Set the dc power supply output for 4.0 ± 0.1 v as measured on the DMM.
3. Enter the Low Voltage Measurement Test Number 311 (`A-CHARGE`, `B-SHELF LIFE`, `C-SHELF LIFE`) for battery Well A.
4. Press the **ENTER** key (`C-SHELF LIFE`) to begin the Voltage Measurement Test.
5. Verify that `A-READY` lights within 15 seconds.
Note: If `DISCARD` lights, this may indicate a failure of the UUT or an incorrect setting of the dc power supply.
6. Press the **EXIT** key (`B-SHELF LIFE`) to terminate the test.
7. Set the dc power supply output for 15.6 ± 0.1 v as measured on the DMM.



BSS 2

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PIP – Instructions

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PIP – Voltage Measurement Test (continued)

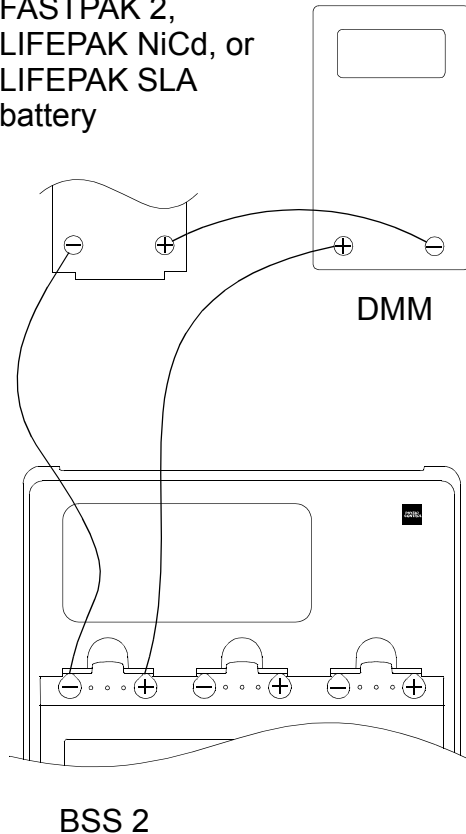
8. Enter the High Voltage Measurement Test Number 321 (A-CHARGE, B-CONDITION, C-SHELF LIFE) for battery Well A.
9. Press the **ENTER** key (C-SHELF LIFE) to begin the Voltage Measurement Test.
10. Verify A-READY lights within 15 seconds.
11. Press the **EXIT** key (B-SHELF LIFE) to terminate the test.
12. Disconnect the UUT from ac line power.
13. Repeat steps 1 through 11 for battery Well B using test numbers 312 (A-CHARGE, B-SHELF LIFE, C-CONDITION) and 322 (A-CHARGE, B-CONDITION, C-CONDITION) for the Low Voltage Measurement and High Voltage Measurement, respectively.
14. Repeat steps 1 through 11 for battery Well C using test numbers 313 (A-CHARGE, B-SHELF LIFE, C-CHARGE) and 323 (A-CHARGE, B-CONDITION, C-CHARGE) for the Low Voltage Measurement and High Voltage Measurement, respectively.
15. Disconnect the UUT from the test setup.
16. Record the results in the PIP Checklist.
17. Continue to the next test while in Performance Inspection Mode.

PIP – Instructions

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PIP – Charge Test

FASTPAK 2,
LIFEPAK NiCd, or
LIFEPAK SLA
battery



The Charge Test verifies the UUT capability to deliver charge current to a test battery at two specified levels. Each battery well must be individually tested. To perform the Charge Test:

1. Establish the test setup shown at the left.

Note: A reversed polarity connection anywhere in the test setup causes DISCARD to light. Check the setup and try the test again.

2. Enter the Low Current Charge Test Number 201 (A-CONDITION, B-none, C-SHELF LIFE) for battery Well A.
3. Press the **ENTER** key (C-SHELF LIFE) to begin the Charge Test.
4. Verify that A-READY lights within 5 seconds and that the DMM indicates a charge current of 200 ± 30 ma.
5. Press the **EXIT** key (B-SHELF LIFE) to terminate the test.
6. Enter the High Current Charge Test Number 211 for battery Well A.
7. Verify the UUT illuminates the Well A READY lights within 5 seconds and the DMM indicates a charge current of 1200 ± 50 ma.
8. Press the **EXIT** key (B-SHELF LIFE) to terminate the test.

PIP – Instructions

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PIP – Charge Test (continued)

9. Repeat steps 1 through 8 for Well B using test numbers 202 (A-CONDITION, B-none, C-CONDITION) and 212 (A-CONDITION, B-SHELF LIFE, C-CONDITION) for the Low Current Charge and High Current Charge tests, respectively.
10. Repeat steps 1 through 8 for Well C using test numbers 203 (A-CONDITION, B-none, C-CHARGE) and 213 (A-CONDITION, B-SHELF LIFE, C-CHARGE) for the Low Current Charge and High Current Charge tests, respectively.
11. Record the results in the PIP Checklist.
12. Continue to the next test while in Performance Inspection Mode.

PIP – Low/Medium Current Discharge Test

The Low Current Discharge Test verifies the UUT capability to draw low discharge currents from a test battery at two specified levels. Each battery well must be individually tested. To perform the Low Current Discharge Test:

1. Establish the test setup shown on the following page.

Note: A reversed polarity connection anywhere in the test setup causes the DISCARD to light. Check the setup and try the test again.

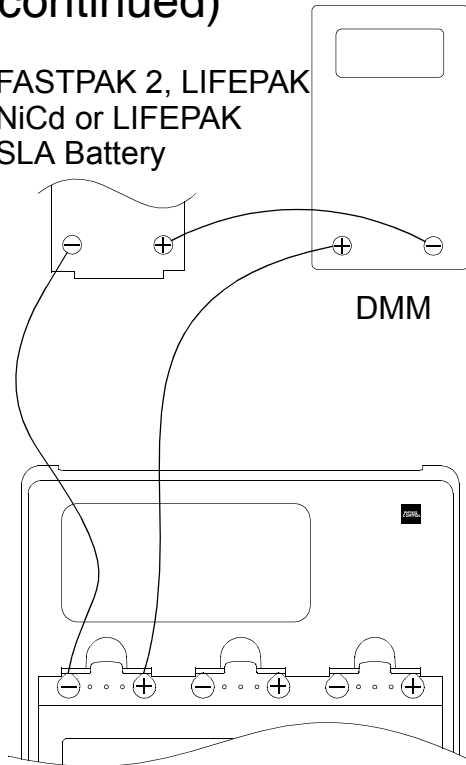
Note: A depleted battery may not be able to supply the currents required to successfully complete the discharge test.

PIP – Instructions

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PIP – Low/Medium Current Discharge Test (continued)

FASTPAK 2, LIFEPAK
NiCd or LIFEPAK
SLA Battery



2. Enter the Low Current Discharge Test Number 221 (A-CONDITION, B-CONDITION, C-SHELF LIFE) for battery Well A.
3. Press the **ENTER** key (C-SHELF LIFE) to begin the Low/Medium Current Discharge Test.
4. Verify that A-READY lights within 5 seconds and the DMM indicates a discharge current of -200 ± 30 ma.
5. Press the **EXIT** key (B-SHELF LIFE) to terminate the test.
6. Enter the Medium Current Discharge Test Number 231 (A-CONDITION, B-CHARGE, C-SHELF LIFE) for battery Well A.
7. Press the **ENTER** key (C-SHELF LIFE) to begin the Low/Medium Current Discharge Test.
8. Verify that A-READY lights within 5 seconds and the DMM indicates a discharge current of -1200 ± 50 ma.
9. Press the **EXIT** key (B-SHELF LIFE) to terminate the test.

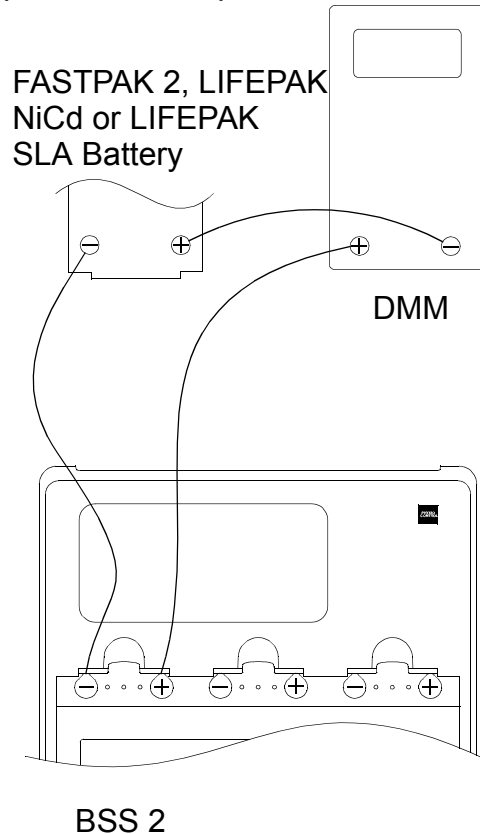
BSS 2

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PIP – Instructions

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PIP – Low/Medium Current Discharge Test (continued)



10. Repeat steps 1 through 9 for Well B using test numbers 222 (A-CONDITION, B-CONDITION, C-CONDITION) and 232 (A-CONDITION, B-CHARGE, C-CONDITION) for the Low Current Discharge and Medium Current Discharge tests, respectively.
11. Repeat steps 1 through 9 for Well C using test numbers 223 (A-CONDITION, B-CONDITION, C-CHARGE) and 233 (A-CONDITION, B-CHARGE, C-CHARGE) for the Low Current Discharge and Medium Current Discharge tests, respectively.
12. Record the results in the PIP Checklist.
13. Continue to the next test while in Performance Inspection Mode.

PIP – Instructions

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PIP – High Current Discharge Test

The High Current Discharge Test verifies the UUT capability to draw high discharge currents from a test battery. Each battery well must be individually tested. To perform the High Current Discharge Test:

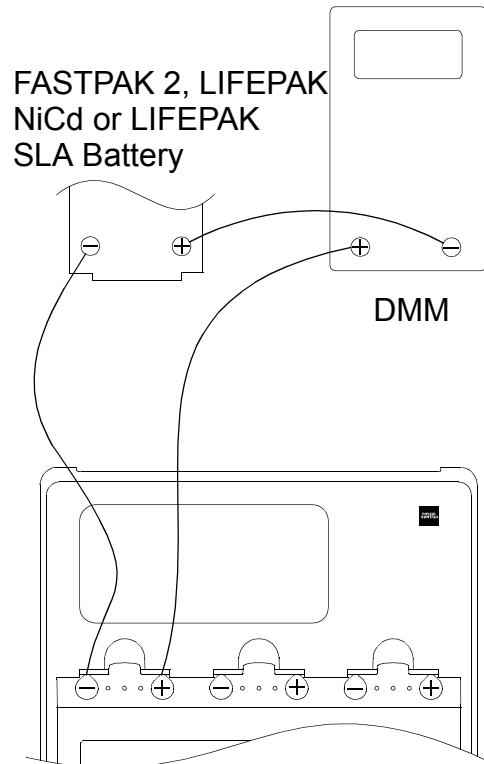
1. Establish the test setup shown on the left.

Note: A reversed polarity connection anywhere in the test setup causes DISCARD to light. Check the setup and try the test again.

Note: During the High Current Discharge Test, the UUT draws high current from the battery well for 15 seconds. During this period the test operator must verify the current measurement on the DMM.

Note: A depleted battery may not be able to supply the currents required to successfully complete the discharge test.

2. Enter the High Current Discharge Test Number 301 (A-CHARGE, B-none, C-SHELF LIFE) for battery Well A.
3. Press the **ENTER** key (C-SHELF LIFE) to begin the High Current Discharge Test.



PIP – Instructions

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PIP – High Current Discharge Test (continued)

4. Verify that A-READY lights within 5 seconds and the DMM indicates a discharge current of -6000 ± 600 ma.
5. Press the **EXIT** key (B-SHELF LIFE) to terminate the test.
6. Repeat steps 1 through 5 for battery Well B using test number 302 (A-CHARGE, B-none, C-CONDITION).
7. Repeat steps 1 through 5 for battery Well B using test number 303 (A-CHARGE, B-none, C-CHARGE).
8. Disconnect the test setup.
9. Disconnect the UUT from ac line power.
10. Record the results in the PIP Checklist.
11. Continue to the next test.

PIP – Instructions

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PIP – Leakage Current

Check the leakage current in accordance with the following industry standards:

- AAMI/ANSI (Association for the Advancement of Medical Instrumentation/ American National Standards Institute) DF2-1989, DF39-1993
- IEC (International Electrotechnical Commission) 601-1 and 601-2-4

WARNING!

Shock Hazard. Failure to properly perform these tests could result in a failure to detect excessive leakage current. Make sure you are familiar with your test equipment and these test performance procedures.

Because of the variety of safety analyzers that may be used for these tests, this Service Manual provides only general instructions. For information about configuration and testing methods, refer to your safety analyzer operating instructions.

Each test result applies to a safety analyzer operating from a 120 vac source or 240 vac source, unless indicated otherwise. For exceptions, the test result includes the safety analyzer operating source. For example, 300 μ a (120 vac) or 500 μ a (240 vac).

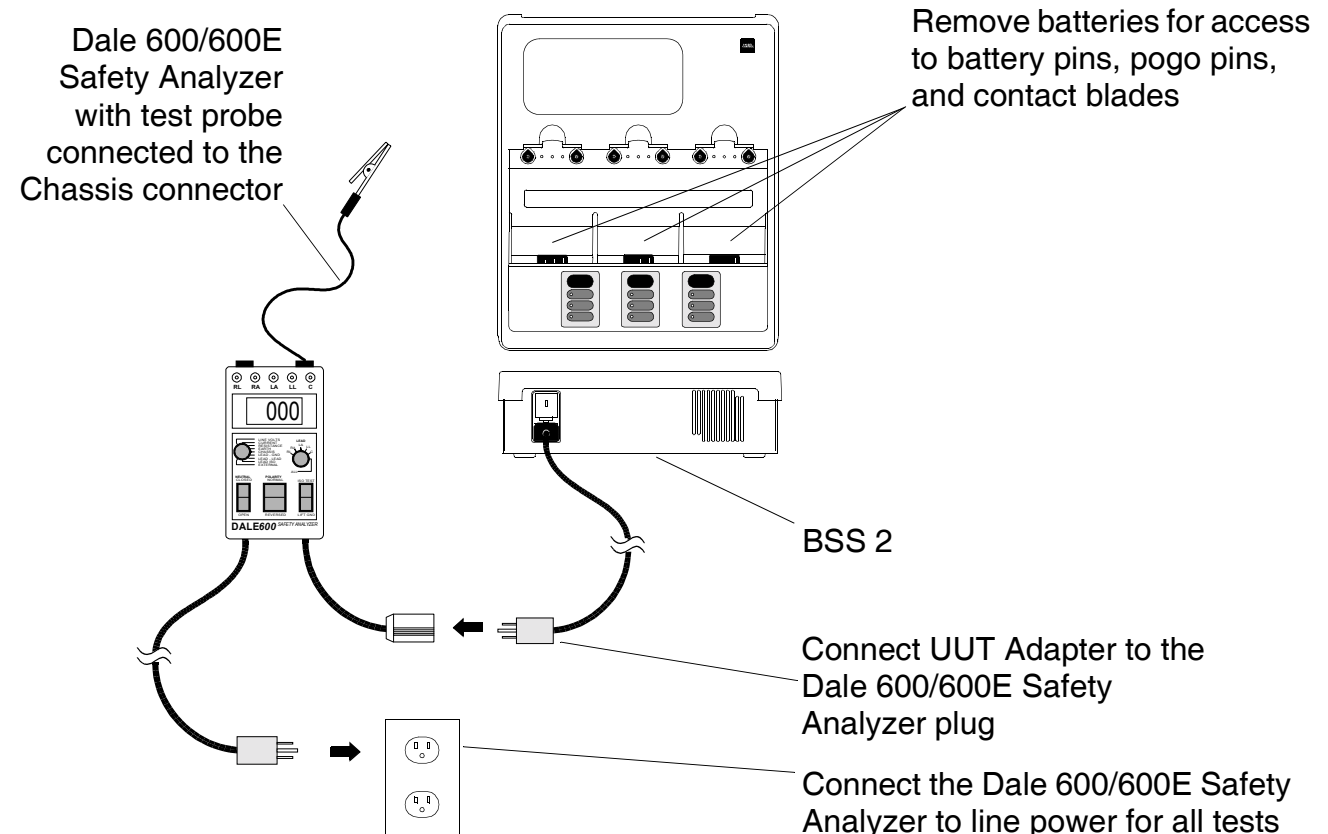
Proceed directly to the [Chassis Leakage Current Setup](#).

PIP – Instructions

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PIP – Chassis Leakage Current Setup

To test chassis leakage current, set up the Safety Analyzer and the BSS 2 as shown below. Continue to the **Chassis Leakage Current Procedure** when you complete the setup.



PIP – Instructions

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PIP – Chassis Leakage
Current Procedure

- To test Chassis Leakage Current:
1. Establish the **Chassis Leakage Current Setup** shown in the figure on the previous page.
 2. Set the Safety Analyzer controls to:

Neutral	Polarity	Mode	Lead
Closed	Normal	Leakage μ a	Chassis
 3. Connect the analyzer chassis clip to the negative (-) battery pin of battery Well A.
 4. Verify measured current is less than 100 μ a.
 5. Repeat steps 3 and 4 for battery Wells B and C.
 6. Record the worst-case current (highest reading) of the three battery wells in the PIP checklist.
 7. Connect the analyzer chassis clip to the Well A negative battery pin, and press the **LIFT GND** button on the analyzer.
 8. Verify measured current is less than 300 μ a (120 vac) or 500 μ a (240 vac).

PIP – Instructions

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PIP – Chassis Leakage Current Procedure (continued)

9. Release the LIFT GND button.
 10. Record the results in the PIP Checklist.
 11. Connect the analyzer chassis clip to the positive (+) battery pin of battery Well A.
 12. Verify measured current is less than 100 μ a.
 13. Repeat steps 11 and 12 for battery Wells B and C.
 14. Record the worst-case current of the three battery wells in the PIP Checklist.
 15. Connect the analyzer chassis clip to the left-most pogo pin of battery Well A.
 16. Verify measured current is less than 100 μ a.
 17. Repeat steps 15 and 16 for all pogo pins and contact blades in battery Wells A, B, and C.
 18. Record the worst-case current of the three battery wells in the PIP Checklist.
- The Performance Inspection Procedure is complete.

Instrument Calibration

There are no user calibrations available on The Battery Support System 2. Questions related to device calibration should be directed to Medtronic Physio-Control. In the USA, call 1.800.442.1142.

Troubleshooting

The Troubleshooting section describes event code usage, interpretation, and corrective action. This section also includes a separate Troubleshooting Chart keyed to **Performance Inspection Procedure** for use in problem resolution. For additional troubleshooting information, refer to the Battery Support System 2 Operating Instructions, **BSS 2 Maintenance: Troubleshooting**.

Event Codes

Event Code Table

Event Codes

Interpreting Event Codes

The Battery Support System 2 (BSS 2) logs an event code whenever an internal program or process fails to execute properly, up to a maximum of 16 events. Event codes rarely occur, but all events that are recorded should be investigated thoroughly before a BSS 2 that displayed the event code is put back into use.

BSS 2 event codes have three digits derived from the front panel LEDs (e.g., 121, 221, 333, etc.) where the first digit is derived from the LEDs on battery Well A, the second digit from the LEDs on battery Well B, and the third digit from the LEDs on battery Well C.

The following table illustrates how to derive event codes from LED displays:

Well A		Well B		Well C	
LED On	Digit	LED On	Digit	LED On	Digit
CHARGE	3	CHARGE	3	CHARGE	3
CONDITION	2	CONDITION	2	CONDITION	2
SHELF LIFE	1	SHELF LIFE	1	SHELF LIFE	1

Event Codes

Page 2 of 4

Event codes stored in the Event Log may not necessarily indicate an error. Event codes can indicate transient electromagnetic interference (EMI) or electrostatic discharge (ESD). If you suspect transient EMI or ESD as the source of an event, **Clear Event Codes(s)**, then complete the **Performance Inspection Procedure** (PIP). If the event code does not recur, it may be the result of EMI or ESD.

If the Event Log is empty, no numerical codes are displayed and the LEDs in all three battery wells remain off.

Viewing Event Codes

1. Unplug the BSS 2 from ac line power.
2. Press and hold **B-SHELF LIFE** and **C-SHELF LIFE** while connecting the BSS 2 to ac line power.
3. The BSS 2 enters power-up self-test mode during which the front panel LEDs for all three light in the following sequence:
 - A-, B-, C-, SHELF LIFE
 - A-, B-, C-, CONDITION
 - A-, B-, C-, CHARGE
 - A-, B-, C-, DISCARD
 - A-, B-, C-, READY
4. Upon completion of power-up self test, the BSS 2 will either:
 - Illuminate the **SERVICE** legend steadily in the event of a self test failure, or
 - Flash the **SERVICE** legend indicating successful completion of self test.

Event Codes

Viewing Event Codes (continued)

5. Within seconds of the self test completion, enter the Performance Inspection Mode Keypad Test passcode by pressing the front panel keys in the following order:

Well A		Well B		Well C	
1	Charge	4	Charge	7	Charge
2	Condition	5	Condition	8	Condition
3	Shelf Test	6	Shelf Test	9	Shelf Test

6. Enter the desired Event Log number (see table, [Keypad Entry of Test Number Digits](#)), then press the **ENTER** key (C-SHELF LIFE).
- Note:** You must use the charge or contition keys to scroll to each desired digit of the event number.
- 1st event:101(A-SHELF LIFE, B-None, C-SHELF LIFE)
2nd event:102 (A-SHELF LIFE, B-None, C-CONDITION)
3rd event: 103 (A-SHELF LIFE, B-None, C-CHARGE)
4th event: 111 (A-SHELF LIFE, B-SHELF LIFE, C-SHELF LIFE)
5th event: 112 (A-SHELF LIFE, B-SHELF LIFE, C-CONDITION)
7. Record and investigate any entries in the Event Log. Always complete the [Performance Inspection Procedure \(PIP\)](#) after finding any event code(s).

Event Codes

Page 4 of 4

Clearing Event Codes

1. To clear the Event Log, scroll to 113 (A-SHELF LIFE, B-SHELF LIFE, C-CHARGE), then press the **ENTER** key (C-SHELF LIFE).
2. If the Event Log is successfully cleared, all three READY LEDs light. If the Event Log does not clear, all three DISCARD LEDs light.
3. Press the **EXIT** (B-SHELF LIFE) key to return to Test Number Entry Mode. To leave Field Test Mode and return to normal operation, press the **EXIT** key a second time, or unplug the power cord.

Event Code Table

The following Event Codes may be logged by the Battery Support System 2. It is unlikely that you will ever experience the majority of these Event Codes because they are related to software operation. After reviewing the Event Log, refer to the Event Code Table for a description of the underlying cause.

Event Code	Description	Event Code	Description
111	Process stack overflow (≥ 20)	212	ROM failure
112	Process stack underflow	213	EEPROM
113	Process not found (in interrupt)	221	Erroneous Op-Code
121	Serial buffer overflow	222	DAC failure
122	Open fuse or bad driver	223	Watchdog (COP) Timeout
132	HC11 CONFIG error	231	Erroneous IRQ
133	System temperature fault	232	Discharge current not met
211	RAM failure	233	Charge current not met

Preventive Maintenance

Periodic maintenance, inspection, and testing of the Battery Support System 2 (BSS 2) will help prevent and detect possible electrical and mechanical malfunctions. The Preventive Maintenance section provides instructions for inspecting, cleaning, and maintaining the BSS 2. Follow these recommendations to help keep the BSS 2 in proper working condition. Before servicing or repairing the BSS 2, familiarize yourself with all of the information in this section.

The **Performance Inspection Procedure** (PIP) is provided in another section of this Service Manual.

Product Useful Life

Preventive Maintenance and Replacement Schedule

Product Support Policy

Battery Maintenance

Cleaning

Storage

Product Useful Life

During product development, the BSS 2 and its subassemblies are subjected to rigorous life testing. This testing and the routine testing and maintenance program recommended in this Service Manual will help to provide reliable device operation for many years.

However, both rapid technological changes and the availability of older replacement parts limit the useful life of all modern medical devices. The American Hospital Association suggests a 5-year useful life expectancy for defibrillators (*Estimated Useful Lives of Depreciable Hospital Assets, Revised 1993 Edition*). The US Army lists an 8-year life expectancy for defibrillators (technical bulletin: *Maintenance Expenditure Limits for Medical TB MED 7 Revision 8 October 1993*). Medtronic Physio-Control Corp. recommends that you adopt an 8-year useful life expectancy for this device.

Preventive Maintenance and Replacement Schedule

The following table contains recommended maintenance/replacement intervals:

Activity	As Needed	12 Months	24 Months
PIP	•	•	
Exterior Inspection	•	•	
Interior Inspection	•		
Exterior Cleaning	•	•	
Interior Cleaning	•		
Battery Pin Replacement	•		•
Pogo pin Replacement	•		•

Product Support Policy

Medtronic Physio-Control Corp. provides full technical support and replacement parts for a period of 8 years from the date of shipment from our manufacturing facility. After this 8-year period, Medtronic Physio-Control Corp. provides technical support and replacement parts as available.

Battery Maintenance

Refer to the [Battery Support System 2 Operating Instructions](#) for detailed and comprehensive recommendations for maximizing battery performance and life.

Cleaning

Tools and Materials

The tools and materials required to perform an external and internal cleaning of the Battery Support System 2 are shown below.

Product	Description
Static discharge protected work area	Grounded conductive surface and wrist strap
Isopropyl alcohol	
Soap and water	
Quaternary ammonium compounds	
Peroxide (peracetic acid) solutions	
Cotton swabs	
Vacuum cleaner	
Soft-bristle brush	Nonmetallic
Cloth	Clean and lint-free
Compressed air	Clean and dry (60 psi, maximum)

Cleaning

Page 2 of 3

External Cleaning Procedures

Clean the exterior of the BSS 2 by wiping the surface with any of the following solutions:

- Soap and water
- Quaternary ammonium compounds
- Isopropyl alcohol
- Peroxide (peracetic acid) solutions

WARNING!

Shock or fire hazard. Do not immerse or soak any portion of this Battery Support System 2 in water or any other fluid. Avoid spilling any fluid on the Battery Support System 2 or accessories.

CAUTION!

Possible case damage. Do not use bleach, bleach dilution, or phenolic compounds. Do not steam or gas sterilize. Do not autoclave the BSS 2.

Cleaning

Page 3 of 3

Internal Cleaning Procedures

CAUTION!

Possible component damage. The PCB assemblies contain static sensitive devices (SSDs). To avoid damage, observe special handling practices described in the section [Static Sensitive Device Handling](#).

To clean the interior of the BSS 2:

1. Brush interior surfaces and parts with a nonmetallic soft-bristle brush.
2. Remove loosened dirt and dust using a dry, low-pressure compressed air (60 psi) or vacuum cleaner.
3. Wipe metal surfaces with a soft, nonabrasive cloth that has been dampened with isopropyl alcohol.

Storage

When the BSS 2 is not in use, follow these recommendations for storage of the BSS 2 with batteries installed:

- Store at temperatures between 0°C and +35°C (+32°F and +95°F°).

When the BSS 2 is not in use, follow these recommendations for storage of the BSS 2 without installed batteries:

- Store at temperatures between -32°C and +65°C (-26°F and +149°F).

Replacement Procedures

The Replacement Procedures are a set of detailed instructions for disassembly, handling, and reassembly of replaceable Battery Support System 2 (BSS 2) assemblies. Perform the Interior Inspection whenever the BSS 2 case must be opened for service.

When disconnecting cables and wire harnesses, label the cables and connections so that they match easily during reassembly, e.g., J1, J3, etc. Each “P” connection mates to a corresponding “J” connector with the same number. For example, P3 mates with J3. Refer to the [Interconnect Diagram](#) for additional connection information.

Warnings and Cautions

Static Sensitive Device Handling

Case Half Separation

Main PCB (A01) Removal

Fan Assembly (A03)

Transformer Assembly (A02)

Chassis Ground Cable Assembly (W01)

Replacement Procedures (continued)

Power Supply Cable Assembly (W02)

Power Entry Module (A04)

Bottom Case Disassembly

Bottom Case Reassembly

Contact Block PCB (A06)

Pogo Pin Replacement

Battery Pin Replacement

Keypad Assembly (A07) Removal

Keypad Assembly (A07) Installation

Warnings and Cautions

The following general warnings and cautions apply to all actions you may perform during maintenance of the Battery Support System 2. Other, more specific, warnings and cautions appear throughout this Service Manual.

WARNING!

Possible shock and BSS 2 damage. Unless reassembled properly, it is possible to pinch and damage wires during reassembly. To avoid pinching wires, carefully follow reassembly instructions.

CAUTION!

Possible component damage. The Main PCB assembly contains static-sensitive devices (SSDs). To avoid damage, observe the special handling practices described in the section titled Static Sensitive Device Handling.

Static Sensitive Device Handling

Page 1 of 2

Many electronic devices can be damaged by the discharge of static electricity. Static discharges commonly occur when the operator wears synthetic clothes and transfers the charge to any object touched. These discharges can damage or destroy Static Sensitive Devices (SSDs). In most cases, the discharge is not perceptible to the person who causes it.

To prevent static discharge damage to SSDs, observe the following precautions during any open-case test, maintenance, or repair procedures:

Use Static-Dissipative Mat

Always perform repair or maintenance on a static-dissipative mat that is connected to earth ground.

Static Sensitive Device Handling

Page 2 of 2

Wear a Wrist Strap

Always wear a conductive wrist strap connected to the mat and to ground except when working on energized equipment or when discharging high voltage circuits. The strap must be snug enough to make good contact against bare skin.

WARNING!

Shock hazard. Remove the wrist strap when working on energized equipment or when discharging high voltage circuits.

Transport and Store PCBs Properly

Transport and store PCBs in anti-static racks or inside conductive bags. Label the package that contains the PCBs as static-sensitive.

Keep Work Area Static-Free

Keep static-generating products such as styrofoam cups or trays away from the work area. Connect all electrical equipment such as soldering irons and test equipment to ground with a three-prong plug.

Test Work Area Routinely

Test all the anti-static parts of the work area (mat, straps, cables) routinely. Keep a log of the test results.

Case Half Separation

CAUTION!

Possible component damage. The Main PCB assembly contains static sensitive devices (SSDs). To avoid damage, observe the special handling practices described in the section titled [Static Sensitive Device Handling](#).

Begin Bottom Case Disassembly with Case Half Separation:

Refer to the [Interconnect Diagram](#) to locate PCBs and connectors.

1. Turn the BSS 2 upside down and remove the six screws (4) holding the top and bottom cases together.

Note: Do not reuse the case screws if the BSS 2 is used in mobile applications, e.g., mounted in an ambulance or aircraft. Replace them with new screws during reassembly.

2. Holding the top and bottom cases together, turn the unit right side up. Gently lift the rear of the top case away and disconnect P3 (from center of Main PCB to battery contacts).
3. Carefully cut the three tie wraps inside the front of the Bottom Case (near P4, P5, and P6).

Case Half Separation

Page 2 of 2

4. Disconnect P4 (battery Well A), P5 (battery Well B), and P6 (battery Well C).
5. Disconnect P1 (from the Keypad Assembly).

Note: Do not remove the ferrite bead from the Lower Case Assembly.

6. Lift the Top Case off and set it aside.

Case Half Separation is complete.

Case Half Reassembly

To reassemble the case halves, begin with the bottom case right-side-up, the keypad-end closest to you.

1. Rest the top case on its front edge (in front of the bottom case) and reconnect P1, P3, P4, P5, and P6.
2. Install new tie wraps in the tie wrap anchors adjacent to P4, P5, and P6.
3. Lower the top case onto the bottom case. Holding the two halves together, turn them upside down and reinstall the six case screws.

Main PCB (A01)

To remove the Main PCB (A01), first perform:

■ Case Half Separation

To remove the main PCB:

1. Disconnect P2, P7, P8, and P9. Refer to the [Interconnect Diagram](#), if necessary.
2. Remove 10 screws ([116](#)) securing the Main PCB to the Lower Case. The left-front, center, and right-front mounting screws also have internal-toothed grounding washers ([112](#)).
3. Pull the Main PCB toward the front of the Lower Case and lift it out.
4. Place the Main PCB in a static-protective bag and set it aside.

Main PCB Removal is complete.

Fan Assembly (A03)

To remove the Fan Assembly (A03), first perform:

- **Case Half Separation**
- **Main PCB Removal**

To remove the fan assembly:

1. Remove the two screws (**110**) securing the fan to the Bottom Case.
2. Remove the fan from the chassis.

Fan Assembly removal is complete.

Transformer Assembly (A02)

To remove the Transformer Assembly (A02), first perform:

- **Case Half Separation**
- **Main PCB Removal**

Remove the four kep nuts (**118**) securing the transformer to the Bottom Case and remove the transformer from the chassis.

Transformer Assembly removal is complete.

Chassis Ground Cable Assembly (W01)

To remove the Chassis Ground Cable Assembly (W01), first perform:

■ Case Half Separation

1. Remove spade-lug connections, as necessary, from the Power Entry Module (A04). Label the connections for easy reassembly.
2. Remove the kep nut (**120**) and washer (**118**) from the chassis ground stud.
3. Disconnect the Chassis Ground Cable from the Power Entry Module.

Chassis Ground Cable Assembly Removal is complete.

Power Supply Cable Assembly (W02)

To remove the Power Supply Cable Assembly (W02), first perform:

- **Case Half Separation**

Disconnect P8/J8 and disconnect the Power Supply Cable from the Power Entry Module.

Power Supply Cable Assembly Removal is complete.

Power Entry Module (A04)

To remove the Power Entry Module (A04), first perform:

■ Case Half Separation

1. Disconnect all spade-lug connections.

Note: Take care to label each termination with an indelible marker to facilitate reassembly.

2. Pinch the upper and lower flange of the Power Entry Module together and push it out through the opening in the chassis.
3. If necessary, the Power Entry Module may be disassembled into its individual components:
 - 2 Fuses ([42](#))
 - 4-Position Voltage Selector ([104](#))

Bottom Case Disassembly

To complete Bottom Case Replacement, first perform:

- **Case Half Separation**
- **Main PCB Removal**
- **Fan Assembly**
- **Transformer Assembly**
- **Power Entry Module** (optional)

If necessary, remove the four rubber feet ([102](#)) and serial number ([52](#)).

Bottom Case disassembly is complete.

Bottom Case Reassembly

To reassemble the Bottom Case, reinstall the following components in the order listed:

- **Power Entry Module**
- **Transformer Assembly**
- **Fan Assembly**
- **Main PCB**
- **Case Half Separation**

Contact Block PCB (A06)

To remove the Contact Block PCB (A06).

1. Begin Top Case Disassembly by performing [Case Half Separation](#)
2. On the inside of the Top Case, disconnect J2 (3 places, one on each battery well).
3. From each Contact Block PCB, remove two screws (4). Lift the Contact Block PCB away from the Top Case.

Contact Block PCB removal is complete.

Pogo Pin Replacement

No case disassembly is required to remove or install Pogo Pins. To remove a Pogo Pin, grasp it firmly and pull directly up out of the battery well. If the original pin is not damaged, it may be reinstalled. Or, a new pin may be installed directly into the battery well openings.

Battery Pin Replacement

To replace the battery pins:

Note: Battery pins may be replaced without opening the BSS 2.

1. Using a 5/32 inch nut driver, gently unscrew the desired battery pin from the battery grommet.
2. Gently thread the replacement battery pin into the battery grommet until finger tight.
3. Use the nut driver to snug the battery pin into place. Do not overtighten.

Keypad Assembly (A07) Removal

To remove the Keypad Assembly (A07):

Note: The Keypad cannot be reused. Once removed, a new Keypad is required for reassembly.

1. Perform **Case Half Separation**.
2. Turn the top case right side up. Using an Exacto knife or a flat-bladed screw driver, gently pry the Keypad away from the top case. Begin prying in the battery Well C corner (opposite the words “Physio-Control Battery Support System 2”).
3. When the Keypad is somewhat free from the top case, press J1 from the bottom, to finish releasing the Keypad adhesive.
4. Use a lint-free, alcohol-dampened cloth to remove any adhesive residue. Allow the area to dry completely.

Keypad Assembly (A07) Installation

To reinstall a new Keypad Assembly:

1. Perform **Case Half Separation** and **Keypad Assembly Removal**.
2. Carefully remove the protective paper backing on the circuit side of the new Keypad.
3. Beginning at the left side (the battery Well A side) of the Keypad recess, carefully align the left edge of the Keypad with the left edge of the recess, taking care to align J1 with the connector opening.
4. Lay the new Keypad down in the recess. Cover with a soft, non-abrasive material (foam or soft paper towel) and apply an even pressure across the surface of the Keypad to ensure a secure bond.

Keypad installation is complete.

Parts Lists and Assembly Diagrams

The Parts List and Assembly Diagrams section provides a reference for use in identifying components needed to repair the Battery Support System 2 (BSS 2).

Upper Case Assembly Parts List: Use this table to locate upper case part numbers. Clicking on a component item number displays a drawing view showing the part installed on the BSS 2 Upper Case Assembly.

Lower Case Assembly Parts List: Use this table to locate lower case component part numbers. Clicking on a component item number displays a drawing view showing the part installed on the BSS 2 lower case assembly.

Accessories lists items necessary to keep the BSS 2 in clinical use.

Assembly Diagrams show components of the BSS 2 as they are installed on the Upper Case Assembly. Numbered call outs identify the individual components. Clicking on a number associated with a call out displays a parts list where the desired component item number can be identified.

Battery Support System 2 Parts Lists

This section contains BSS 2 parts lists. Click Section Contents located at the bottom of the page for an overview of the following parts lists.

[Upper Case Assembly Parts List](#)

[Lower Case Assembly \(A05\) Parts List](#)

[Accessories](#)

Upper Case Assembly Parts List

Page 1 of 3

Item	Quantity	Part Number	Part Description	Used On
A05	1	3010036-01	Assembly, Lower Case	
A06	3	3010044-02	PCB Assembly, Contact Block	
A07	1	3009972-xx	Keypad Assembly -03 English -05 German -06 Spanish -07 Italian -08 Swedish -09 French	
W03	1	3010433-01	Cable Assembly, Keypad/Main PCB	
W04	1	3010033-03	Wire Harness, Main PCB/Battery Pins	
W05	3	3010033-04	Wire Harness, Pogo/Smart/Main PCB	
4	12	202253-570	Screw, Nylok, #6-32 x .375, SS, PH, Pan	
6	1	3011608-013	Upper Case Repair Kit	
8	1	3009065-00	Label - Physio Icon	
10	9	3010016-001	Probe, Spring Contact, (Pogo Pin)	
12	9	3010018-000	Probe Receptacle	Part of item 6

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Upper Case Assembly Parts List

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Item	Quantity	Part Number	Part Description	Used On
14	6	804206-01	Grommet, Battery	Part of item 6
16	6	802278-02	Connector - Plug, Banana Pin	
18	6	201508-000	Nut - Lock, CS, #4-40	
20	7	201457-001	Fastener - Mount, Cable Tie, Adhesive Back	
22	7	200536-001	Retainer - Cable Tie, Nylon, .10W x 4.0L	
34	1	3010045-xx	Label - Battery, Warning -00 English -01 French -02 German -03 Spanish -04 Italian -05 Swedish	

Upper Case Assembly Parts List

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Item	Quantity	Part Number	Part Description	Used On
36	1	3010669-xx	Label - Operating Instructions -012 English -013 French -014 German -03 Spanish -04 Italian -05 Swedish	
42	2	200619-014	Fuse, 5 x 20 mm, 800 ma, 250 v, T, IEC	220/240 vac
	2	200619-017	Fuse, 5 x 20 mm, 1.6 a 250 v, T, IEC	100/120 vac
52	1	3010671-00	Label - Serial Number	

Lower Case Assembly (A05) Parts List

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Item	Quantity	Part Number	Part Description	Used On
Ref	1	3010036-01	Assembly, Lower Case	
A01	1	3011760-00	Assembly, Main PCB	A05
A02	1	3011760-01	Assembly - Transformer, 100-240 v, 50-60 Hz	A05
A03	1	3011760-02	Assembly - Fan, Axial, 18 CFM, 12 vdc, CSA/UL	A05
A04	1	3011760-03	Power Entry Module, 2 Fuse, Snap-in	A05
W01	1	3011760-04	Cable Assembly - Ground, Green	A05
W02	1	3011760-05	Cable Assembly - Power Supply	A05
100	1	3011760-06	Chassis, Lower, Metal	
102	4	3011760-07	Foot, Rubber, .24 x .83 Diameter, Black	
104	1	3011760-08	Voltage Selector, 4 Position, 100 v / 120 v / 220 v / 240 v	A04

Lower Case Assembly (A05) Parts List

Page 2 of 2

Item	Quantity	Part Number	Part Description	Used On
108	1	3011760-09	Fuse, Drawer, 5 x 20 mm, 2 Pole, 4 Position	A04
110	2	3011760-10	Screw, #4-40 x 7/8, SS, PH, Pan	
112	4	3011760-11	Washer, Lock, #4, SS, Internal Tooth (earth ground)	
114	4	3011760-12	Nut - Kep, #8-32 x 11/32in	
116	10	3011760-13	Screw, Nylok, #4-40 x 1/4 in, SS, PH, Pan	
118	1	3011760-14	Washer, Lock, #6, SS, Internal Tooth	
120	1	3011760-15	Nut - Kep, #6-32 x 1/4 in, Sp or SS	
121	3	3201360-620	Fuse, Main PCB, 2.5 A, Fast Blow, 5 x 20 mm	F100, F200, F300

Accessories

Part Number	Description	Used On
3010515-xxx	Operating Instructions - Manual, BSS 2	-000 English -100 French -200 German -300 Spanish -400 Italian -600 Swedish
3010013-02	Service Manual - CD, LIFEPAK 12 defibrillator/ monitor Series, BSS 2	
3101932-00	Wall Mount Option - Kit	
3009376	Battery - LIFEPAK NiCd	
3009375	Battery - FASTPAK 2	
3009378	Battery - LIFEPAK SLA	
9-10424	Battery - FASTPAK	
803650-03 ¹	Power Cord – STD	USA, Canada, Mexico, Saudi Arabia, Taiwan, Korea, Japan, Brazil, Columbia, Ecuador, Venezuela, Panama, Puerto Rico

Accessories

Part Number	Description	Used On
803650-06 ¹	Power Cord – Australian	Australia, New Zealand
803650-08 ¹	Power Cord – European	France, Spain, Germany, Austria, Netherlands, Belgium, Finland, Italy, Sweden, Norway, Denmark, Greece, Portugal, Switzerland, Turkey, Iceland, Cypress, Singapore, Indonesia, China, Bahrain, Israel (non-ARMD), Jordan, Kuwait, Lebanon, Oman, Qatar, UAE, Argentina, Bolivia, Chile, Paraguay, Peru, Uruguay
803650-10 ¹	Power Cord – United Kingdom	England, Philippines, India
803650-12 ¹	Power Cord – South Africa	South Africa (non-military)
803650-17 ¹	Power Cord – UNT	South Africa (govt), Thailand, Israel (ARMD)

¹ Order the appropriate power cord for your country.

Battery Support System 2 Assembly Diagrams

This section contains Battery Support System 2 (BSS 2) assembly diagrams. Numbered call outs identify the individual BSS 2 components.

Exterior Case Components

Interior Case Components

Lower Case Assembly

Detail View of Fan and Transformer Assembly

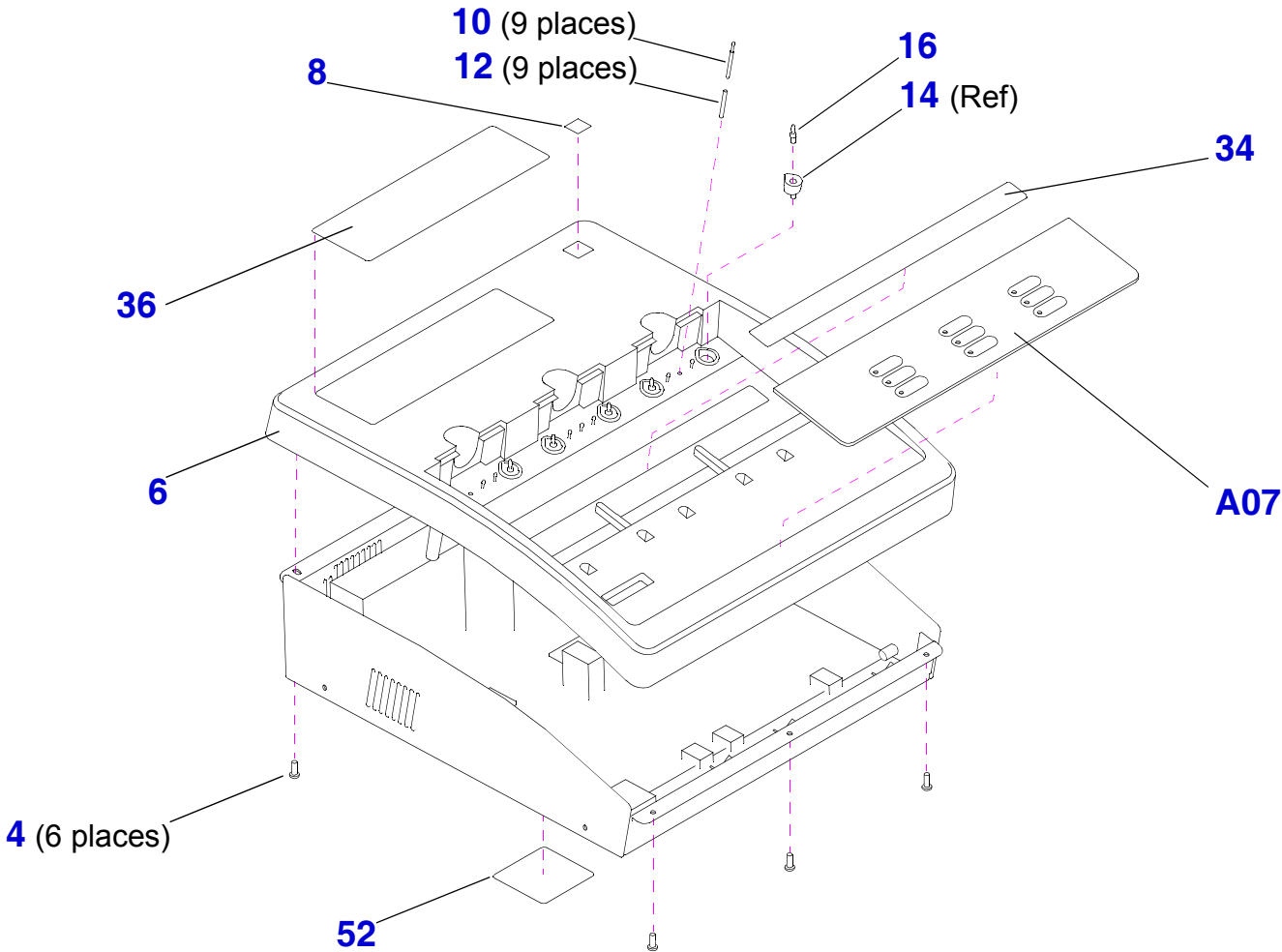
Detail View of Grounding Cable

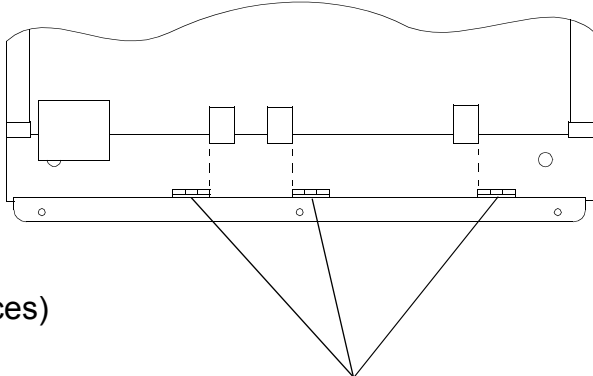
Detail View of Transformer Wire Routing

Detail View of Power Entry Module

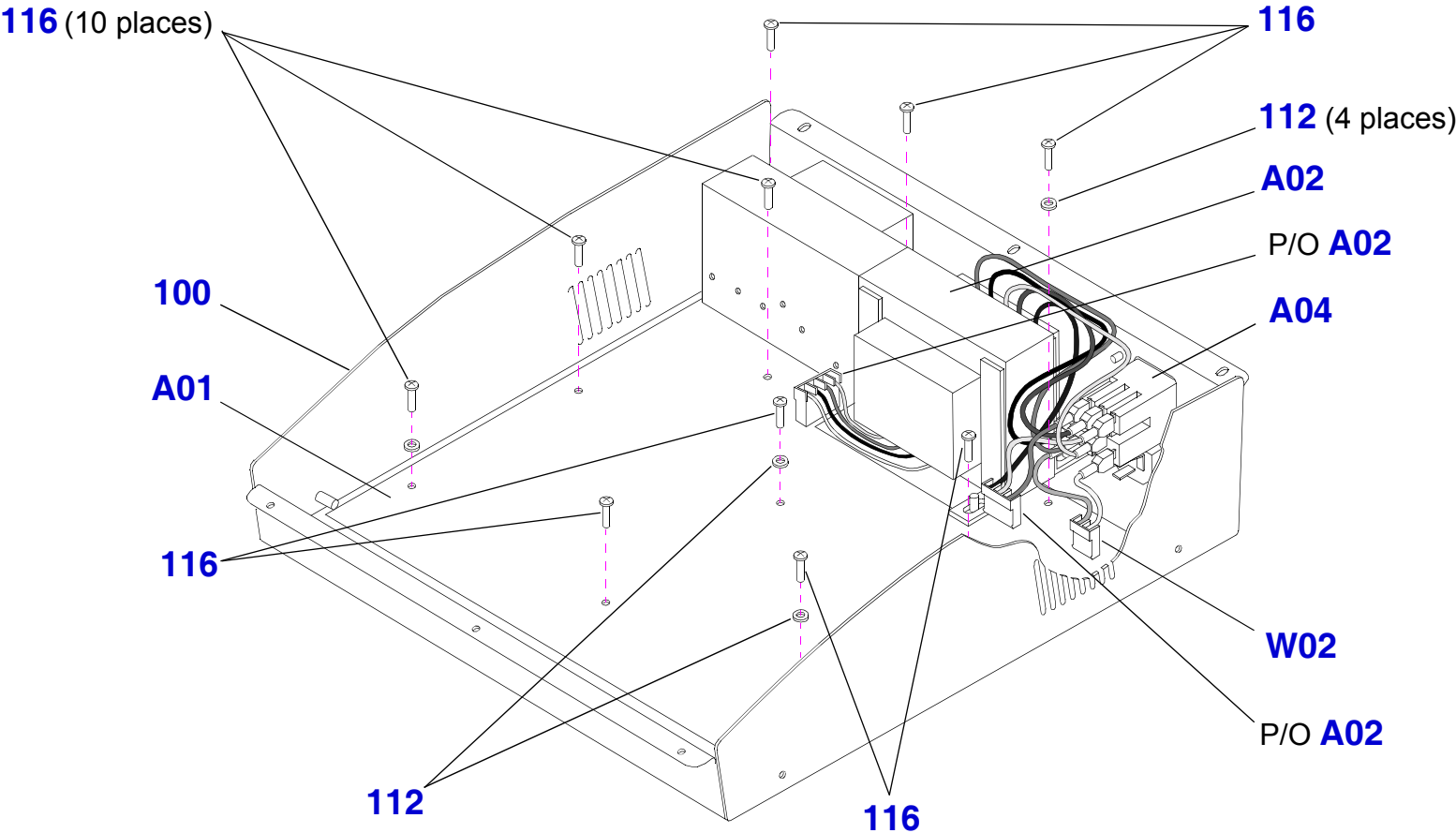
Interconnect Diagram

Exterior Case Components

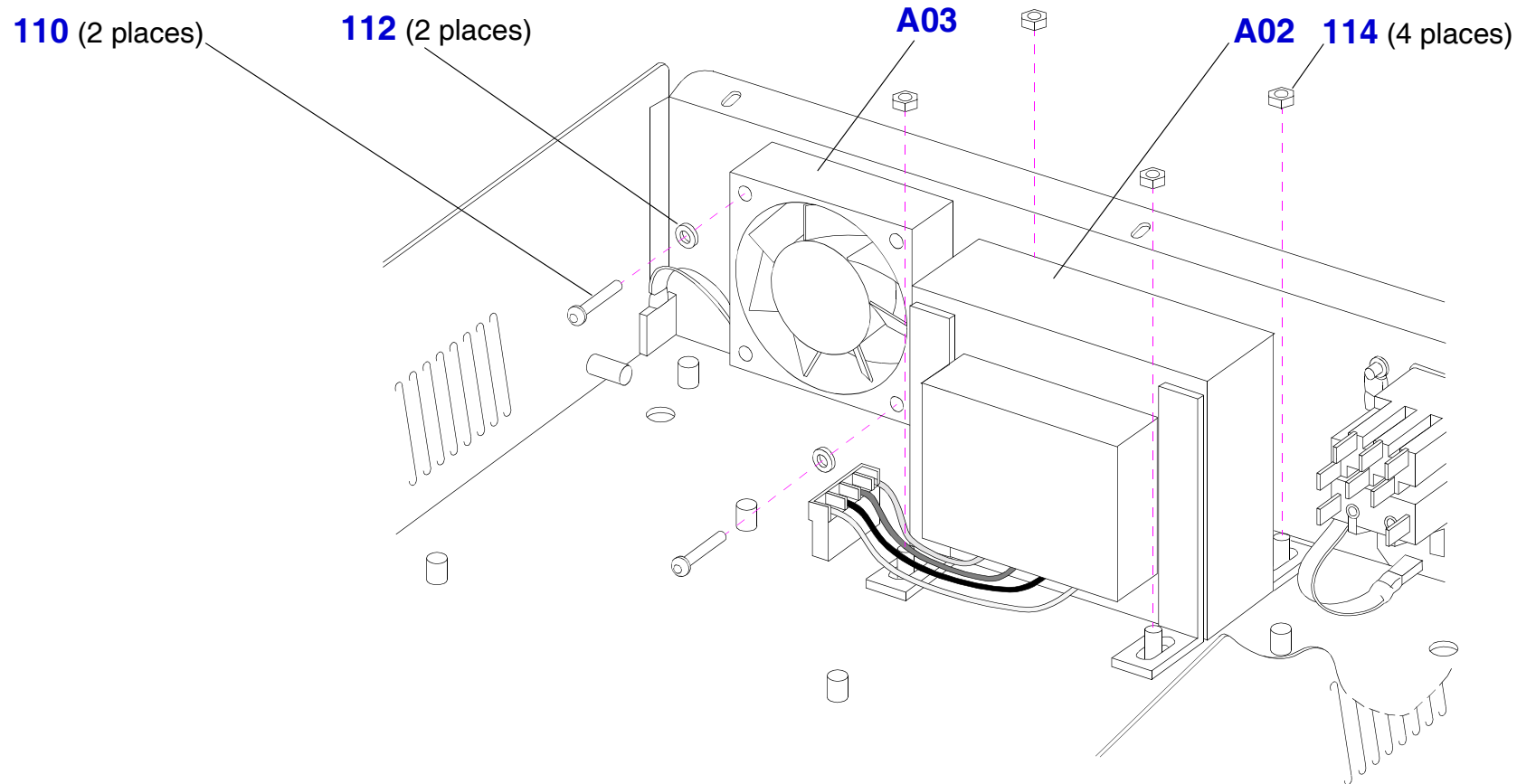




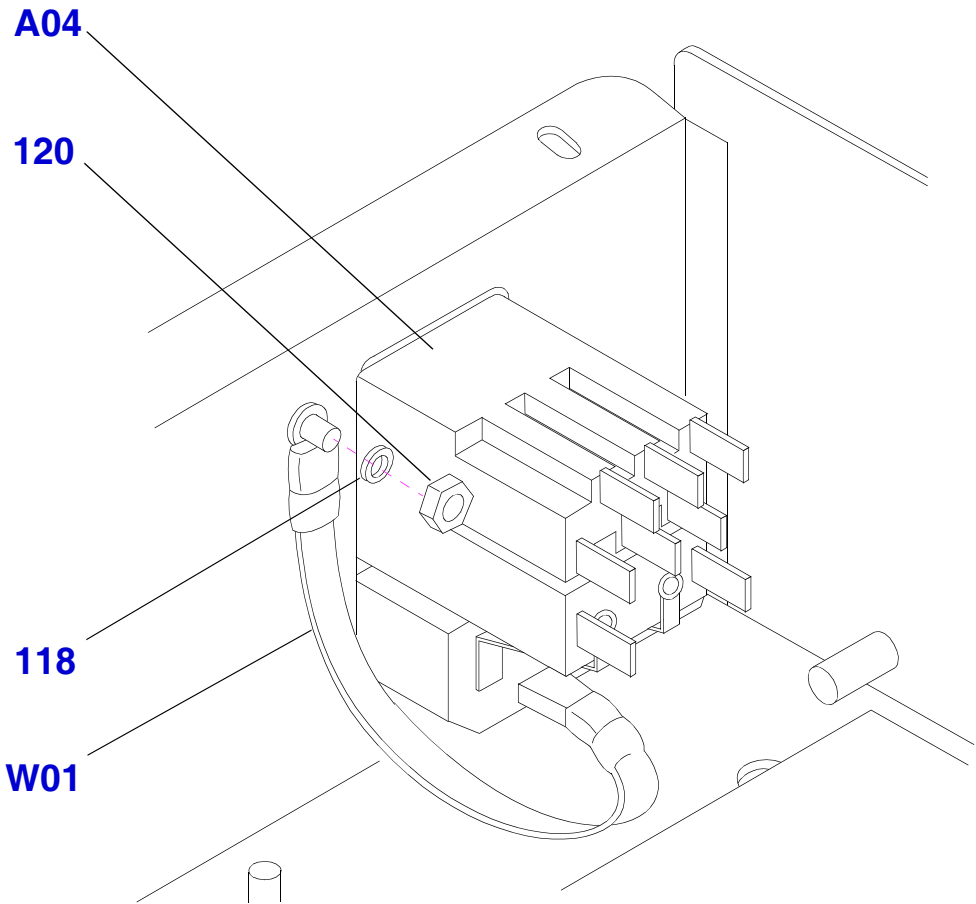
Lower Case Assembly



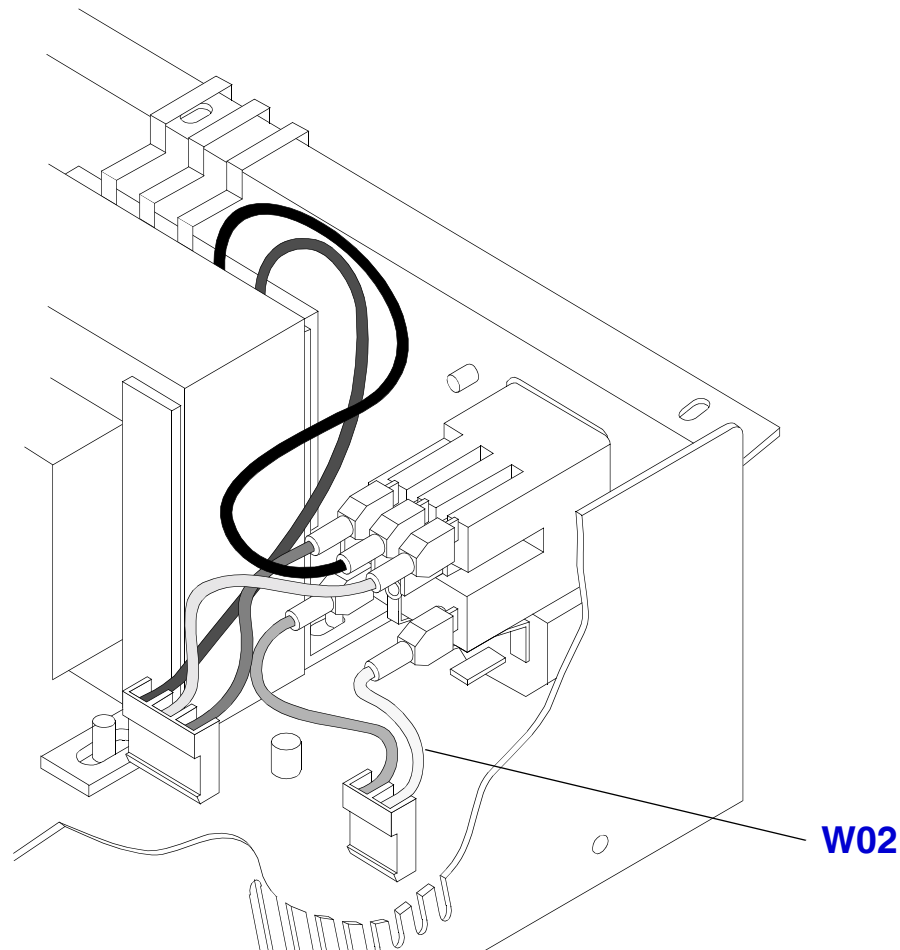
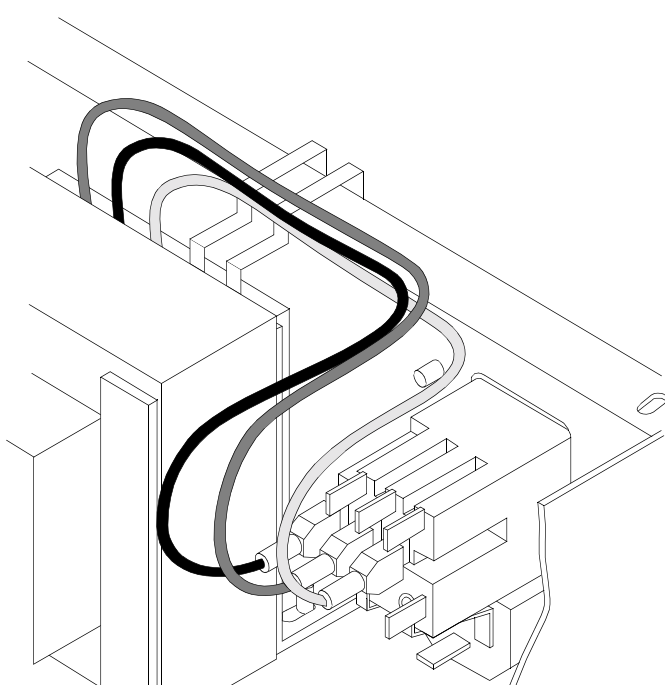
Detail View of Fan and Transformer Assembly



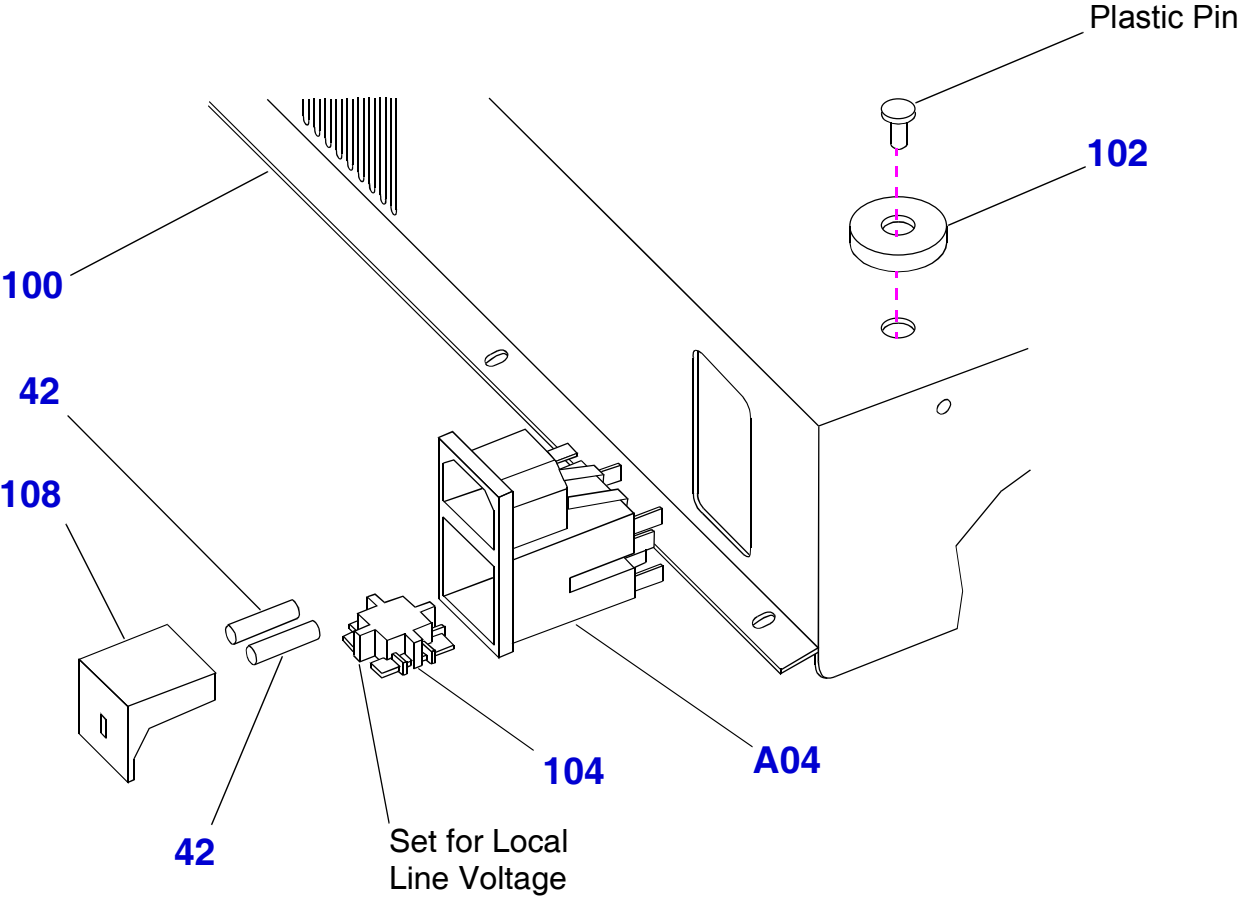
Detail View of Grounding Cable



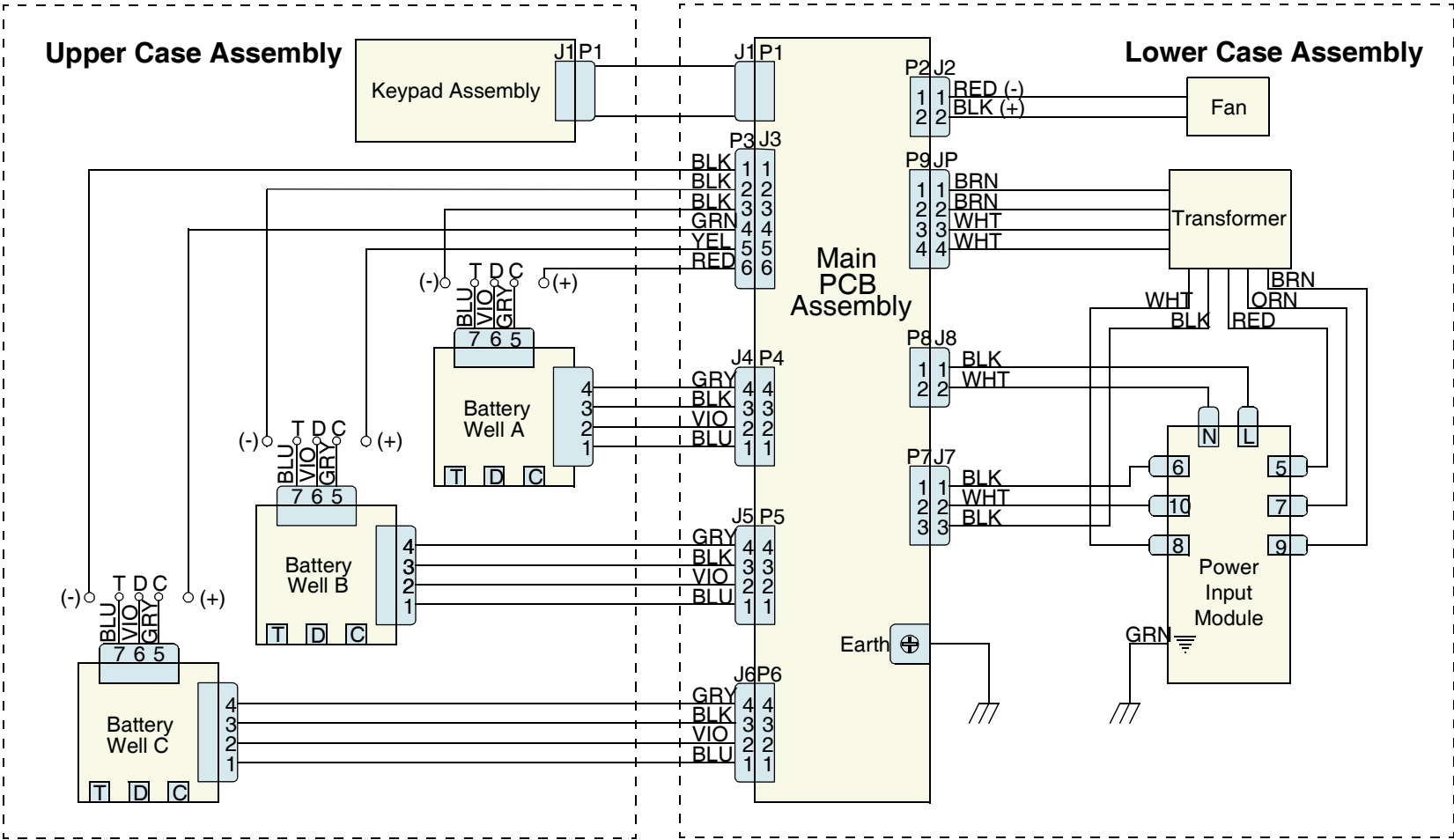
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Detail View of Power Entry Module



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